A STATISTICAL SUPPLEMENT TO THE

1969 ANNUAL REPORT OF THE DEPARTMENT OF WATER & SEWERS CITY OF CHICAGO

BUREAU OF WATER

DETAILED STATISTICAL DATA ON THE OPERATION & MAINTENANCE OF THE CHICAGO WATER SUPPLY SYSTEM

RICHARD J. DALEY
Mayor

JAMES W. JARDINE
Commissioner of Water and Sewers

RAYMOND D. JOHNSOS
Deputy Commissioner for Water

ROBERT O. WALLER
Chief Water Engineer

TABLE OF CONTENTS

BUREAU OF WATER

A SUPPLEMENT

to the

1969 ANNUAL REPORT DEPARTMENT OF WATER AND SEWERS

TABLE

ANNUAL REP...

...TTER

...TER – ...

...y of ...
...Reco...
...h Stati...
...ing S...

...STATI...

...peratio...

...SION OF ...

Central ...
South ...
Water ...
Water ...

WATER ...

CITY OF CHICAGO

DEPARTMENT OF WATER AND SEWERS

BUREAU OF WATER

LEY

JAMES W. JARDINE
COMMISSIONER

RAYMOND D. JOHNSOS
DEPUTY COMMISSIONER
FOR WATER

ROBERT O. WALLER
CHIEF WATER ENGINEER

ROOM 404, CITY HALL TELEPHONE 744-7004-6-8 CHICAGO, ILLINOIS 60602

May 1, 1970

. James W. Jardine
mmissioner
partment of Water and Sewers
ty of Chicago

ar Commissioner Jardine:

are pleased to submit this annual report of the Bureau of Water as a pplement to the 1969 Annual Report of the Department of Water and Sewers. contains detailed information and data concerning the activities of the icago Water System and related functions for which the Bureau of Water is sponsible. We believe the Chicago Water System did a satisfactory job ring the year in furnishing a high quality potable water to the residents Chicago and the 72 suburban communities served by the system.

he world's two largest water treatment plants processed an average of 1056 illion gallons of water a day, 668 million gallons by the Central Water iltration Plant and 388 million gallons by the South Water Filtration Plant. here has been some unavoidable delay in the tunnel construction connecting he Central Plant and the Dever Crib so that it will be sometime in 1970 be- ore this plant has a second raw water intake in addition to the shore intake.

he Chicago Water System pumped a total of 373,575 million gallons of water uring the year, an average of 1,023.49 million gallons a day, slightly less han the total average for 1968. On July 16, the maximum pumpage for the day eached 1618.92 million gallons with a maximum (peak) hour of 2180 million allons a day at 8 P.M.

he Five-Year Capital Improvement Program scheduled for the system during the eriod 1970 through 1974 calls for an estimated expenditure of $18,520,000 or filtration plant modification and additions; $36,211,000 for feeder and mall water main revisions and extensions; $18,322,000 for improvements to umping stations; and $35,000,000 for the construction of water tunnels and hafts - a total of $108,053,000 for the five year period. Actual expenditures or Capital Improvements in the system amounted to a total of $11,702,281 dur- ing 1969.

Distribution Division Work forces installed a total of 20-1/4 miles of water mains in the distribution system during the year, about 1/3 of which were water

mains of 24 inch or larger in diameter. The division did all the preliminary work necessary during the year so that the contractor can begin cleaning and cement lining 13,155 feet of 36 inch cast iron feeder main early in 1970. As a result of this cleaning and lining work, the capacity of the mains involved will be increased by an estimated 65%.

At the year end the Collection Division was servicing 512,403 water accounts and during the year a total of $59,082,480 was collected of which $47,516,788 were from meter rate accounts; $11,403,675 from assessed rate accounts; $57,871 from sewer rental accounts for properties outside the corporate limits of the City; and $104,146 from miscellaneous sources.

Bureau personnel spent a considerable amount of time during the year in keeping abreast of the developments in water pollution control and water quality standard activities and where ever possible assisted the City, State and Federal agencies involved in these activities, particularly in the presentation of data obtained from our Lake Michigan raw water quality sampling surveys.

Other items of interest are the good progress made in the seven year program to update the instrumentation and chemical feed systems at the South Water Filtration Plant to bring this plant to a comparable position in this regard with the Central Water Filtration Plant; the completion of the 78 inch concrete discharge tunnel at the Mayfair Pumping Station under the John F. Kennedy Expressway; the on-schedule conversion of the boiler equipment in the five steam pumping stations from coal to gas fuel; the progress made on the survey by the consultant to find an alternate method to dispose of the sediment and filter wash water at the two filtration plants; and the several new laboratory tools placed in use at the Central Laboratory to obtain better analysis and surveillance of the water processing through the two filtration plants.

During 1969 four valuable executives in the Bureau of Water retired; Robert O. Waller, Chief Water Engineer on October 2, 1969; Timothy F. Foley, General Superintendent of Water Distribution on May 15, 1969; Nicholas H. Kuehn, Jr., Engineer of Water Pumping on October 31, 1969; and James T. Cooper, Supervisor of Inventory Control on April 9, 1969.

We wish to publically express our sincere appreciation to each employee in the Bureau for the very conscientious manner in which he discharged his responsibilities all during the year. Further, we acknowledge with gratitude the generous cooperation and assistance given to us by Mayor Richard J. Daley, members of the City Council, other City Departments and governmental agencies, the industrial community and the public we serve. And finally, your guidance and assistance was most helpful to the Bureau in providing a vital service to the community.

Respectfully submitted,

R. D. Johnson

Deputy Commissioner for Water

SUMMARY OF STATISTICS - CHICAGO WATER SYSTEM
Year Ending December 31, 1969
GENERAL STATISTICS

Date of Construction . . . . . 1852 to date
By Whom Owned . . . . . City of Chicago
Source of Supply - By gravity from intakes 2 to 3 miles out in Lake Michigan through tunnels to Filtration Plants and then to Pumping Stations, direct pumping into mains.

WATER CONSUMPTION

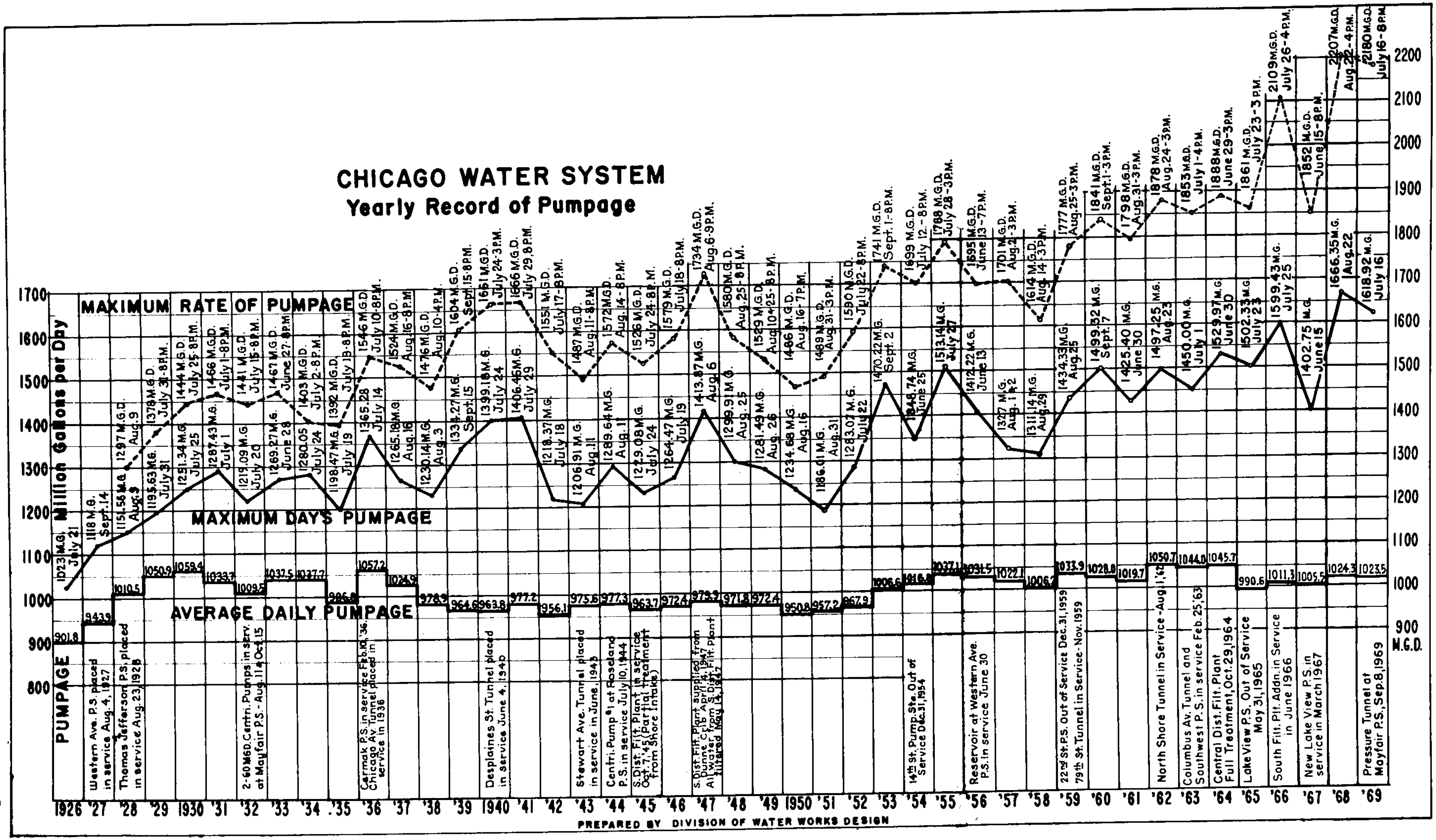
Population of Chicago Supplied	3,551,000
Population of Outside Communities Supplied by Chicago	1,187,000
Total Population Supplied	4,738,000
Pumpage to City of Chicago - gallons	314,480,200,000
Water delivered through meters to communities and industries outside of Chicago - gallons	59,094,400,000
Total Annual Pumpage of Water System - gallons	373,574,600,000
Annual Metered Revenue Water Consumption within City Limits of Chicago - gallons	154,884,600,000
Percentage of City Water Consumption metered - Revenue & Free	52.5%
Average Daily Pumpage of Water System - gallons	1,023,490,000
Maximum Day's Pumpage in 1969 - July 16	1,618,920,000
Maximum Rate of Pumpage in 1969 - July 16, 8 p.m.	2,180,000,000
Average Daily Consumption in Chicago - gallons	861,600,000
Average Daily Consumption Outside of City - gallons	161,900,000
Gallons per day to each inhabitant - City	243
Gallons per day to each inhabitant - Outside of City	136
Gallons per day to each inhabitant - Entire Service Area	216
Annual Average of Total Head at Pumping Stations - Feet	122.99

SERVICES

Kind of Pipe and Sizes	Lead 3/4 in. to 2-in.; Cast Iron 3-in. to 36-in
Assessed Services	348,026
Meters in Service	164,377
Total Services	512,403
New Meters Installed during the year	2,730
Meters removed	2,076
Percentage of Services Metered	32.1%
Percentage of Total Pumpage Metered	60.0%
Revenue from Assessed Rates	$11,403,675.23
Revenue from Metered Rates	$47,516,787.59
Percentage of Revenue from Metered Rates	80.6%

DISTRIBUTION SYSTEM

Kind of Pipe	Cast Iron, Concrete, Steel and Ductile Iron
Sizes (Inches)	4 to 60
Mains extended during year - miles	20.26
Mains disconnected during year - miles	10.14
Mains in use - miles (Cast Iron 3,900.32; Concrete 95.53; Steel 8.09; Ductile Iron 123.89)	Total 4127.83
Hydrants added during year	175
Hydrants abandoned during the year	82
Hydrants now in use	45,957
Gate Valves added during year	420
Gate Valves abandoned during year	97
Gate Valves now in use	42,981
Pressure Range in Mains - 28 to 58 lbs. per Square Inch	


CHICAGO WATER SYSTEM
Yearly Record of Pumpage
MAXIMUM RATE OF PUMPAGE
MAXIMUM DAYS PUMPAGE
AVERAGE DAILY PUMPAGE
PUMPAGE
Million Gallons per Day
M.G.D.
Western Ave. P.S. placed in service Aug. 4, 1927
Thomas Jefferson P.S. placed in service Aug. 23, 1928
2-60 MGD Centri. Pumps in serv. at Mayfair P.S. - Aug. 11 & Oct. 15
Carmak P.S. in service Feb. 10, '36. Chicago Av. Tunnel placed in service in 1936
Desplaines St. Tunnel placed in service June 4, 1940
Stewart Ave. Tunnel placed in service in June, 1943
Centri. Pump #1 at Roseland P.S. in service July 10, 1944
S. Dist. Filt. Plant in service Oct. 7, '45 (Partial treatment from Shore Intake)
S. Dist. Filt. Plant supplied from Dunne Crib April 4, 1947. All water from S. Dist. Filt. Plant filtered May 14, 1947
14th St. Pump. Sta. Out of Service Dec. 31, 1954
Reservoir at Western Ave. P.S. in service June 30
22nd St. P.S. Out of Service Dec. 31, 1959
79th St. Tunnel in Service - Nov. 1959
North Shore Tunnel in Service - Aug. 1, '62
Columbus Av. Tunnel and Southwest P.S. in service Feb. 25, '63
Central Dist. Filt. Plant Full Treatment, Oct. 29, 1964
Lake View P.S. Out of Service May 31, 1965
South Filt. Plt. Addn. in Service in June 1966
New Lake View P.S. in service in March 1967
Pressure Tunnel at Mayfair P.S. Sep. 8, 1969
1926 '27 '28 '29 1930 '31 '32 '33 '34 '35 '36 '37 '38 '39 1940 '41 '42 '43 '44 '45 '46 '47 '48 '49 1950 '51 '52 '53 '54 '55 '56 '57 '58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69
PREPARED BY DIVISION OF WATER WORKS DESIGN

GROWTH STATISTICS OF THE WATER WORKS SYSTEM OF THE CITY OF CHICAGO FROM 1854 TO 1969, INCLUSIVE

	OUTSIDE COMMUNITIES			GRAND TOTAL			Rated Pumping Capacity M. G. D.	Average Total Head in Ft.	NUMBER IN SERVICE					REVENUE (Cash Basis)				For Each Mill. Gal. Pumped	COAL		ELEC. POWER		†Total Average Cost Per Mill. Ft. Gals.	Year
	Population #	Consumption Gallons Average Per Day	Consump. Gals. Per Capita	Population #	Pumpage Gallons Average Per Day	Pumpage Gals. Per Capita			Total Services	Meters	Fire Hydrants	Gate Valves	Miles of Water Pipe	Metered Water	Unmetered Water	Miscellaneous Sources	Total			Total Tons	Average Cost Per Ton	1000 K.W. Hrs.	Average Cost per 1000 KW.Hrs.		
				65,000	591,000		8				123		30							504					1854
				80,000	2,393,000		8				158		43							1,079					1855
				90,000	4,000,000		8				169		52												1856
				90,000	3,552,000		8				182		58							1,966					1857
				90,000	2,991,000		20				273		72												1858
				100,000	3,877,000		20				388		85							2,324					1859
				109,000	4,704,000		20				415		91							2,621					1860
				120,000	4,842,000		20				434		95							2,431	$ 3.84			.0864	1861
				136,000	6,075,000		20			65	480		105							2,970	3.53			.0865	1862
				150,000	6,400,000		20			99	548	298	118							3,130	6.53			.1236	1863
				161,000	6,913,000		20			133	606	332	127							3,149	9.94			.1849	1864
				178,000	7,610,000		20			147	762	402	141							3,450	9.21			.1525	1865
				200,000	8,682,000		20			179	790	454	156							3,680	8.51			.1403	1866
				230,000	11,562,000		27			253	919	457	179							5,316	7.30			.1186	1867
				256,000	14,725,000		35			400	1,070	501	209							5,584	7.60			.1245	1868
				281,000	18,633,000		35			530	1,294	623	240							6,737	6.93			.1171	1869
				307,000	21,766,000		35			656	1,552	1,076	272							9,311	7.49			.1131	1870
				332,000	23,465,000		35			341	1,667	1,392	288							10,267	8.09			.1203	1871
				357,000	27,547,000		50			618	1,799	1,537	311							13,925	7.18			.1164	1872
				382,000	32,117,000		66			836	2,254	1,794	351							15,120	8.56			.1225	1873
				395,000	38,091,000		66			1,174	2,607	2,123	386							16,958	8.27			.1168	1874
				408,000	39,845,000		66			1,113	2,835	2,416	410							12,318	7.92			.1030	1875
				421,000	41,931,000		66			1,446	2,901	2,590	416							16,805	7.15			.0846	1876
				441,000	52,184,000		96			1,623	3,002	2,701	425							17,303	5.38			.0611	1877
				461,000	53,601,000		96			1,888	3,130	2,836	430							13,028	4.39			.0514	1878
				482,000	56,322,000		96			2,067	3,228	2,992	441							18,557	4.12			.0534	1879
				503,000	57,384,000		96			2,113	3,361	3,105	455							16,363	4.37			.0537	1880
				538,000	63,923,000		96			2,169	3,553	3,531	472							16,756	5.51			.0636	1881
				561,000	66,167,000		96			2,310	3,872	3,720	497							15,120	4.58			.0645	1882
				601,000	73,266,000		96			2,503	4,144	3,861	519							20,203	4.28			.0648	1883
				641,000	80,018,000		96			2,685	4,616	4,022	543							20,286	5.04			.0639	1884
				681,000	91,650,000		126			2,897	4,943	4,196	565							27,719	4.39			.0543	1885
				721,000	97,790,000		126			3,085	5,350	4,432	596							29,442	4.60			.0586	1886
				762,000	101,938,000		126			3,273	5,889	4,736	638							29,645	4.54			.0595	1887
				803,000	104,316,000		150			3,122	6,378	5,099	677							30,174	4.60			.0621	1888
				850,000	110,896,000		150			3,287	10,456	7,444	730							30,617	4.07			.0527	1889
				1,170,000	152,372,000		229			3,924	11,836	8,595	1,205							46,190	3.48			.0623	1890
				1,235,000	174,114,000		240	110.0		4,131	13,411	9,739	1,347	$ 717,068.05	$ 1,647,395.04					47,221	4.02			.0617	1891
				1,360,000	194,086,000		270	99.8		4,326	14,099	10,384	1,402	795,292.72	1,943,141.38					55,293	3.99			.0562	1892
				1,485,000	236,434,000		323	112.9		4,654	14,894	11,014	1,474	1,000,582.70	1,948,966.17					80,050	4.32			.0552	1893
				1,505,000	238,560,000		323	111.6		4,878	15,771	11,597	1,547	1,012,395.56	2,146,097.38					82,139	4.13			.0682	1894
				1,525,000	251,606,000		323	109.9		5,120	16,466	12,073	1,612	1,004,203.48	2,314,280.37					89,033	3.78			.0630	1895
				1,555,000	253,981,000		323	109.9		5,106	17,375	12,907	1,691	1,039,283.43	2,187,276.30					89,538	3.63			.0460	1896
				1,590,000	265,265,000		323	106.5		5,396	17,833	13,366	1,730	937,654.61	2,240,052.22					91,582	3.79			.0476	1897
				1,627,000	272,776,000		323	106.5		5,837	18,311	14,025	1,801	1,087,858.31	2,401,532.56					92,452	3.42			.0496	1898
				1,667,000	300,379,000		381	111.6		6,185	18,825	14,484	1,847	1,086,948.44	2,115,883.33					98,932	3.36			.0405	1899
				1,727,560	322,683,000		381	110.9		6,396	19,108	14,862	1,872	1,144,644.36	2,105,837.49					94,590	3.41			.0479	1900
				1,776,230	342,961,000		460	105.6		6,728	19,324	15,147	1,890	1,249,063.44	2,121,527.24					96,235	3.67			.0522	1901
				1,824,900	358,179,000		500	102.4		7,075	19,645	15,437	1,918	1,344,671.84	2,266,886.97					92,257	2.87			.0419	1902
				1,873,570	376,090,000		500	103.8		7,298	19,922	15,681	1,939	1,412,178.14	2,277,447.66					118,645	2.69			.0442	1903
				1,922,260	399,065,000		492	103.4		8,102	20,349	16,095	1,978	1,616,464.44	2,218,076.86					123,850	2.69			.0443	1904
				1,970,930	410,930,000		498	103.9		10,559	20,794	16,814	2,038	1,646,329.65	2,372,876.23					125,971	2.55			.0425	1905
				2,019,600	437,059,000		513	108.4		12,301	21,183	17,424	2,073	1,870,647.31	2,410,418.19					131,900	2.38			.0389	1906
				2,068,270	455,194,000		610	113.7		14,441	22,127	18,254	2,153	1,944,700.49	2,505,649.12					136,332	2.15			.0376	1907
				2,116,940	469,282,000		610	112.5		14,724	22,696	18,782	2,189	2,017,354.36	2,630,945.18					142,839	2.26			.0364	1908
				2,165,600	480,905,000		610	113.8		14,883	23,339	19,277	2,230	2,166,224.52	2,865,783.96					147,198	2.41			.0378	1909
				2,214,280	518,579,000		635	112.4		15,032	23,980	19,710	2,272	2,429,431.75	3,018,825.80					147,088	2.40			.0362	1910
				2,262,950	507,332,000		685	115.7	258,886	16,628	24,897	20,488	2,362	2,556,594.32	3,134,700.02		$302,476.98			155,748	2.40			.0371	1911
				2,345,750	515,322,000		728	115.8	270,932	16,052	25,542	21,099	2,425	2,877,279.90	3,327,574.16		58,280.69			159,176	2.308			.0390	1912
				2,370,000	577,860,575		771	120.2		16,969	25,687	21,918	2,405	3,028,232.72	3,467,676.03		64,133.46			166,630	2.379			.0358	1913
				2,393,325	613,323,000		871	120.7	288,595	18,474	27,035	22,668	2,524	3,015,230.12	3,371,227.26		72,057.45			170,379	2.208			.0353	1914
				2,447,000	606,701,671	249.0	897	115.4	292,215	19,489	28,278	23,998	2,641	2,752,539.82	3,358,960.34		69,231.92			182,481	2.137			.0369	1915
				2,491,930	628,000,000	249.0	928	113.3	299,877	20,768	29,842	25,471	2,758	3,081,168.08	3,446,490.69		70,346.34			193,811	2.083			.0358	1916
				2,571,940	641,460,000	249.0	923	110.3	305,717	22,709	30,740	26,093	2,842	3,512,364.30	3,588,455.17		87,473.86			193,618	2.001			.0318	1917
				2,679,900	667,800,000	249.0	1,028	105.2	307,813	25,401	31,100	26,458	2,871	3,926,067.57	3,425,869.64		145,510.02			201,442	3.200			.0492	1918
				2,787,870	714,451,000	256.0	1,118	108.2	309,241	27,740	31,556	26,947	2,916	4,303,025.01	3,428,962.93		183,020.68			201,004	4.170			.060	1919
				2,905,850	773,100,000	266.0	1,147	108.9	313,392	29,921	31,759	27,232	2,941	4,762,424.42	3,362,492.88		220,482.09			202,954	4.133			.062	1920
				2,979,310	787,987,000	264.5	1,142	113.9	322,338	30,089	32,075	27,527	2,974	4,658,176.74	3,377,000.31		175,669.65			189,047	5.737			.074	1921
				3,054,180	800,440,000	262.1	1,379	115.2	332,657	31,366	32,561	28,079	3,027	4,884,778.68	3,512,261.36		207,806.97			173,120	6.236			.087	1921
				3,129,270	805,966,000	257.6	1,359	118.0	345,692	33,356	33,134	28,796	3,099	5,515,637.98	3,622,978.90		377,358.78			8,210,846	6.711			.077	1922
				3,225,450	841,981,000	261.0	1,399	117.5	360,744	38,560	33,901	29,559	3,176	5,780,928.25	3,701,102.23		480,705.20			9,962,736	6.68			.067	1923
				3,470,310	943,948,000	272.0	1,674	121.5	392,099	64,511	36,592	32,092	3,440	7,759,840.13	4,312,065.12		440,744.22			12,512,649	6.47			.061	1928
				3,571,480	1,010,427,000	282.9	1,834	125.5	396,542	68,505	37,376	32,944	3,512	8,387,225.94	4,360,045.72		749,922.16			13,497,193	6.82			.064	1927
				3,654,990	1,050,943,000	287.5	1,834	130.5	404,542	80,905	38,066	33,711	3,582	8,953,658.16	4,466,069.43		518,196.73			13,937,923	6.32			.059	1930
				3,683,565	1,059,441,100	287.6	1,834	126.9	422,066	85,845	38,812	34,494	3,642	9,214,596.58	4,277,479.84		626,219.17			14,115,127	6.33			.059	1931
				3,688,500	1,033,693,000	280.2	1,834	126.3	426,373	102,027	39,289	35,161	3,692	8,948,366.03	4,068,743.67		628,375.60			13,640,485	6.30			.056	1932
				3,709,260	1,009,489,000	272.1	1,954	123.8	422,643	109,174	39,519	35,420	3,712	8,139,245.49	3,603,972.01		543,391.53			12,286,609	6.03			.055	1933
				3,713,550	1,037,468,493	279.4	1,894	123.0	416,665	112,984	39,586	35,719	3,724	8,871,688.68	3,447,193.77		772,726.38			13,091,608	6.33			.056	1934
				3,717,890	1,037,715,070	279.1	1,849	122.0	414,796	111,970	39,708	36,141	3,734	9,646,972.54	3,278,730.46		649,851.88			13,575,555	6.88			.061	1935
				3,722,070	986,753,425	265.1	1,849	121.0	413,189	111,773	39,833	36,575	3,747	9,498,053.41	3,426,957.16		542,514.67			13,467,525	6.24			.060	1936
				3,741,520	942,331,766	252.0	2,149	124.3	412,476	112,070	40,070	36,995	3,768	10,359,321.00	3,630,268.75		704,570.31			14,694,160	6.08			.062	1937
				3,736,165	1,024,868,493	274.3	2,229	123.3	411,608	112,245	40,402	37,579	3,777	10,556,180.80	3,703,811.37		699,228.31			14,959,220	6.48			.066	1938
				3,741,230	978,857,534	261.6	2,309	124.8	410,975	113,616	40,746	38,217	3,805	9,599,478.93	3,502,989.14		571,582.15			13,674,050	6.22			.063	1939
				3,745,530	964,638,356	257.5	2,309	126.0	412,228	115,025	41,009	38,657	3,823	9,723,473.19	3,545,193.24		470,742.90			13,739,409	6.28			.064	1940
				3,761,360	963,775,956	256.2	2,309	126.1	414,434	115,174	41,295	38,965	3,837	9,804,665.96	3,521,314.01		506,439.67			13,832,319	6.64			.065	1941
				3,776,000	977,183,562	259.0	2,249	126.4	415,231	115,332	41,666	39,260	3,851	10,449,024.00	3,669,498.62		463,299.02			14,581,821	6.84			.066	1942
				3,777,000	956,098,630	253.1	2,224	126.3	416,649	115,469	41,834	39,385	3,861	11,400,314.84	3,719,774.31		487,365.29			15,607,454	6.44			.069	1943
				3,785,200	975,556,164	257.6	2,160	125.7	417,440	115,070	41,955	39,538	3,871	12,037,353.35	3,838,867.33		447,316.38			16,323,537	6.06			.070	1944
				3,787,000	977,265,000	258.1	2,285	124.7	418,913	115,469	42,151	39,665	3,883	12,551,878.09	3,774,058.46		470,064.32			16,796,000	6.87			.072	1945
				3,793,000	963,720,000	251.6	2,345	123.0	420,397	115,016	42,296	39,788	3,894	12,515,582.06	3,822,815.92		478,476.03			16,816,874	6.01			.074	1946
				4,048,000	972,392,000	240.2	2,375	122.6	422,235	115,672	42,568	40,011	3,914	13,046,130.49	3,876,419.99		692,731.23			17,615,281	7.71			.083	1947
				4,080,000	979,871,000	240.0	2,455	123.3	424,821	116,190	42,766	40,198	3,927	13,543,685.84	3,903,413.06		746,996.27			18,194,095	6.17			.083	1948
				4,107,000	971,814,000	236.6	2,430	124.6	430,356	118,531	42,987	40,445	3,945	13,905,236.49	3,969,827.06		679,830.69			18,554,894	6.24			.098	1949
				4,134,000	972,362,000	235.2	2,555	128.6	434,552	120,850	43,162	40,717	3,959	13,615,858.05	4,035,425.71		787,821.63			18,439,105	5.96			.095	1950
				4,363,000	1,037,468,493	279.4	1,894	123.0	416,665	112,984	39,586	35,719	3,724	9,646,972.54	3,278,730.46		649,851.88			13,575,555	6.88			.061	1935
				4,155,000	967,937,000	• 233.0	2,560	132.4	452,579	122,946	43,712	41,228	3,992	21,954,920.98	6,660,822.53		711,791.29			29,327,534	8.80			.097	1953
				4,194,000	1,006,564,000	• 240.0	2,435	135.3	459,484	123,787	43,954	41,549	4,016	23,178,314.86	7,002,225.38	1,194,008.59				31,374,548	8.35			.100	1954
				4,221,000	1,016,762,000	• 240.9	2,535	138.3	466,522	125,875	44,121	41,798	4,036	23,156,211.11	6,751,950.30	1,262,540.15				31,170,701	8.56			.093	1955
				4,258,000	1,037,074,000	• 243.6	2,400	136.0	474,414	132,436	44,548	42,261	4,067	23,670,632.64	7,167,956.37	890,022.83				31,728,611	8.04			.102	1956
				4,285,000	1,031,527,000	• 240.7	2,480	135.5	482,235	138,647	44,919	42,625	4,100	23,647,630.86	6,782,355.76	1,019,202.69				31,449,184	8.31			.111	1957
				4,324,000	1,022,055,000	• 236.4	2,620	133.3	489,046	142,734	44,947	42,845	4,115	28,159,098.63	8,352,132.99	1,309,602.40				37,820,834	8.02			.133	1958
				4,361,000	1,006,216,000	• 230.7	2,600	131.4	493,515	145,904	45,072	43,151	4,135	30,825,119.67	8,908,487.53	1,434,401.85				41,168,009	8.05			.134	1959
				4,393,000	1,033,927,000	• 235.4	2,570	132.9	495,851	148,354	45,121	43,267	4,124	31,385,400.30	9,075,697.26	1,641,859.07				42,102,957	8.07			.135	1960
				4,423,000	1,027,956,000	232.4	2,695	132.6	500,436	151,836	45,244	43,592	4,142	30,868,364.13	8,916,408.23	1,573,513.61				41,358,285	8.07			.141	1961
				4,434,000	1,019,652,000	230.0	2,855	133.4	500,798	154,086	□ 45,097	□ 40,915	□ 4,027	36,932,985.63	11,000,203.78	1,342,837.67				49,276,027	06			.125	1962
				4,463,000	1,050,671,000	235.4	2,855	133.2	502,735	157,084	45,237	41,158	4,041	43,256,263.68	12,120,797.37	1,325,439.76				56,702,500	81			.132	1963
				4,501,000	1,043,960,000	231.9	3,030	130.1	504,023	159,885	45,371	41,459	4,058	43,528,981.73	11,880,977.49	1,549,916.68				56,959,875	30			.148	1964
				4,536,000	1,045,670,000	230.5	3,030	127.2	508,270	160,354	45,451	41,770	4,073	43,950,028.06	11,812,294.08	1,266,896.07				57,029,218	21				1965
				4,592,000	990,570,000	216	2,890	123.6	509,297	161,341	45,529	42,040	4,083	43,771,620.34	11,769,087.32	929,110.58				56,469,818	24				1966
				4,615,000	1,011,330,000	219	2,890	126.9	509,368	161,487	45,651	42,255	4,093	44,790,930.02	11,645,476.94	1,522,725.68				57,959,132	64				1967
				4,648,000	1,005,490,000	216	2,995	126.6	509,478	161,754	45,744	42,414	4,107	43,442,100.82	11,444,549.32	1,729,148.80				56,615,791	98				1968
				4,703,000	1,024,290,000	218	2,995	123.4	511,595	163,723	45,864	42,658	4,118	46,353,836.06	11,640,442.01	1,107,510.07				59,101,788	14				1969
				4,738,000	1,023,490,000	216	2,995	123.0	512,403	164,377	45,957	42,981	4,128	47,516,787.59	11,403,675.23	1,227,513.85				60,147,976	67				

to end of year.
l Reports (Based on April 1, 1960 Census)

□ Adjusted to conform to Inventory made during 1960-61.

x Includes Depreciation

†Based on Total Cost of Operation, Repairs and Maintenance of Pumping Stations.

BUREAU OF WATER

CHIEF WATER ENGINEER'S OFFICE

1969 ANNUAL REPORT

PUMPING STATION EFFICIENCY SECTION

W. L. Benjamin
Engineer-in-Charge

The Pumping Station Efficiency Section makes periodic tests of the turbine and electric motor driven pumping units and other equipment at the City of Chicago pumping stations and filtration plants to determine their efficiency and supply the data on which their preventive maintenance programs are based. The boiler water at the five steam stations is checked monthly and recommendations are made to change the treatment when the results of the test indicate a change is needed. Semiannual surveys of the reserve coal supplies at the steam station are made to regulate the coal constants of the stokers and adjust the station log figures. Hydraulic surveys of the water tunnel system are conducted to determine if any changes have occurred in the head loss characteristics of the system.

Central Water Filtration Plant

The six wash water pumps were tested in November 1969. The following tabulation is a summary of the test results.

Unit No.	Efficiency* Percent 1969 Test	Change in Efficiency Percent Since Accept. Test	Change in Efficiency Percent Since Previous Test
1	77.7	+0.2	+0.9
2	76.3	-2.4	+1.3
3	76.8	-0.2	-0.9
4	73.8	-1.4	-0.2
5	77.0	-1.3	-0.5
6	76.8	-0.9	+5.0

*Taken from 1969 test curves at specified pumpage of 28.8 mgd.

The tabulation shows some improvements [illegible] and 5.0% on units No. 1, 2, and [illegible], [illegible] on these units except normal running repairs. [illegible] has been attributed to adjustment [illegible] valves on each wash water discharge piping.

Vibration analysis readings [illegible] bearing pedestals of units No. [illegible] is needed.

Oxygen measurements were made and reported on the [illegible] heater. This test was made on August 25, 1969, and [illegible] oxygen observations of feed water indicate [illegible] be deaerated by spray heater to 0.02 ppm. [illegible] of heater which is rated at 0.007 ppm but is [illegible] single stage heater.

South Water Filtration Plant

A tunnel survey was conducted in April, 1969 of the [illegible] and the Sparling meters on the 73rd and 79th Street outlet [illegible] for accuracy. The Sparling meter on the outlet to 73rd St. [illegible] high and on the 79th St. outlet meter 2.1% low.

Tests were made in April, 1969 on the nine (9) low lift pumping units. The following tabulation shows the results of the tests at the [illegible] of 150 mgd for unit No. 9, 100 mgd for units No. 1, 3, 5 and [illegible] units No. 2, 4, 6 and 8.

Unit No.	Overall Efficiency Percent Test 1969	Change in Efficiency Percent Since Acceptance Tests	Last Major Repairs	Previous Tests
1	84.2	-2.8	----	+1.2
2	86.0	-2.5	-0.3	-1.5
3	85.0	-4.0	----	-1.8
4	85.0	-2.0	-0.3	-2.0
5	87.2	-1.8	+0.2	+0.2
6	84.6	-3.9	----	-1.2
7	87.7	-1.8	-0.1	-0.5
8	83.5	-2.5	----	-1.0
9	84.5	-0.7	----	0.0

Results of tests show that units No. 3 and No. 6 have a change in efficiency of 4.0 and 3.9 percent since acceptance test and should be inspected and necessary repairs be made.

In March 1969, tests were made on the five wash water pumping units. The following tabulation shows the results of the tests at the specified pumpage of 10 mgd for units No. 1, No. 2 and No. 3 and 20 mgd for units No. 4 and

Unit No.	Overall Efficiency Percent Test 1969	Change in Efficiency Percent Since		
		Acceptance Tests	Last Major Repairs	Previous Tests
1	84.0	+7.0	----	+0.8
2	83.0	+0.5	----	-1.3
3	83.6	+3.6	----	-1.4
4	83.2	-0.1	----	-0.6
5	85.4	-0.4	-0.1	+0.4

Results of the tests show very little change in efficiency since previous tests. Unit No. 3 shows a higher vibration (16.2 mills) in the North South direction at the middle steady rest bearing and it was recommended that an inspection be made of this bearing.

Central Park Ave. Pumping Station

The steam turbine driven condensate pump on unit No. 1 was reported as not capable of removing condensate at high loads during February and July, 1969.

Tests made on this pump indicated some wear since installation and it was also concluded that too much water was being recirculated by the sylphon valve on the evactor condenser thereby overloading the pump. The sylphon valve was adjusted for proper operation.

The results of boiler water tests during December, indicated that the chemicals were not getting into boiler. An investigation showed the chemical line to the feed water heater to be plugged and the tap to be improperly placed. This condition was corrected.

Chicago Ave. Pumping Station

In October 1969, tests were run on the six main pumping units. The following is a tabulation of overall efficiency from test curves at the units average operating rate for the year 1968.

Unit No.	Pumpage (mgd) Specified	Pumpage (mgd) Average	Efficiency Percent Test 1969	Change in Efficency Percent Since Accept. Test	Last Major Repair	Previous Test
1	40	47.3	73.3	+0.8	+0.5	-0.5
2	40	45.6	71.3	-5.7	-3.2	-0.7
3	40	51.4	75.8	-4.4	+1.3	+1.3
4	40	47.1	73.7	-4.3	-1.8	-0.8
5	50	49.8	84.1	-4.9	----	-1.9
6	50	48.0	83.0	-6.2	----	-0.6

The average station log total head was 105.7 ft during the year, 1968.

No major repairs other than normal running repairs have been made on these units since previous tests. It was recommended units No. 5 and No. 6 be inspected for necessary repairs. These units have a loss of 4.9% and 6.2% respectively.

Cermak Pumping Station

Tests were made during June 1969, on all six main pumping units. The following is a tabulation of overall efficiency from test curves at the units average pumping rate (mgd) for the year, 1968 at an average station log total head of 97.86 ft.

Unit No.	Pumpage (mgd) Specified	Pumpage (mgd) Average	Efficiency Percent Test 1969	Change in Efficiency Percent Since Accept. Test	Last Major Repair	Previous Test
1	50	65.4	85.2	-2.0	+0.9	0.0
2	50	61.6	86.6	-2.1	+0.4	-0.6
3	50	65.5	86.7	-0.3	-0.3	+0.7
4	50	61.7	82.0	-4.8	-4.7	-1.3
5	50	60.1	86.2	-2.2	-0.4	-0.6
6	50	64.9	85.0	-1.6	-0.8	-0.6

It was recommended that unit No. 4 be inspected and necessary repairs be made. The outboard pump bearing on units No. 5 and No. 6 shows considerable increase in axial vibration and should be inspected for thrust bearing clearance.

Lakeview Pumping Station

Tests were made in July on the three electric motor driven pumping units. The following is a tabulation of the overall efficiency from the test curves at the specified pumpage of 35 mgd.

Unit No.	Overall Efficiency Acceptance Test Previous Test	Test 1969	Change in Efficiency Percent
1	87.5	87.0	-0.1
2	89.0	87.0	-2.0
3	88.6	88.2	-0.4

Mayfair Pumping Station

Tests were made on the six main pumping units in June and August, 1969. The following tabulation shows the results of these tests at the specified capacity, head and/or speed.

Unit No.	Specified Pumpage mgd	Specified Total Hd. ft.	Average* Pumpage Year 1968	Duty 1969 Test	Change in Duty Percent Since Accept. Test	Last Major Repairs	Previous Test
1	60	235	34.8	168.3	-15.8	-1.2	+0.4
2	60	235	53.6	179.5	- 8.4	-2.2	-1.8
3	80	235	58.0	211.8	- 3.3	----	+0.3
4	80	235	62.1	218.2	+ 0.5	----	+3.6
6	60	235	50.3	180.5	- 8.8	-1.5	-1.8
7	60	235	43.6	180.1	- 1.4	+5.3	-0.9

*All at an average station log total head of 163.2 ft high or 135.0 ft low pressure.

In August 1969, tests were made on the new electric motor driven condensate pumps of Pumps No. 1 and No. 2. The electric motor driven condensate pumps are rated at 65 gpm and 150 ft total head. The actual maximum condensate pumped with unit No. 1 is 61.4 gpm and unit No. 2 is 52.5 gpm at a total head of 125 ft. The tests and specified ratings indicate the pumps are too large. When pumping at 125 ft total head these units will pump 85 to 100 gpm and the tests show that the amperes per phase would be in excess of motor rating.

This condition was corrected by closing the discharge valve of the unit to maintain about one inch of condensate in the gage glass of the turbine hot well.

Observations and measurements were made in August 1969 of the suction losses of the pumping units. Test results show an excessive loss between the gate shaft and pump suctions due to a sharp turn and change in diameters into and out of the screen shaft.

68th St. Pumping Station

Tests were made in September 1969, on all five main pumping units. The following shows a tabulation of overall efficiency from test curves at the units average pumping rate (mgd) for the year 1968 at an average station log total head of 110.2 ft.

Unit No.	Pumpage (mgd) Specified*	Pumpage (mgd) Average	Efficiency Percent Test 1969	Change in Efficiency Percent Since Accept. Test	Change in Efficiency Percent Since Last Major Repairs	Change in Efficiency Percent Since Previous Test
1	50	52.9	85.2	-4.8	-2.7	-1.2
2	50	53.9	85.2	-3.8	----	-0.1
3	50	58.8	85.6	+0.9	----	-0.9
4	50	60.9	85.7	-1.5	0.0	-0.5
6	50	54.7	80.5	-0.9	----	-0.4

*At 145 ft total head.

Test results show very little change in efficiency since previous tests. Unit No. 1 shows a decrease in efficiency since acceptance test of 4.8%. It was recommended that this unit be inspected and necessary repairs be made. The axial vibration on the pump outboard bearing of unit No. 4 has more than doubled and this bearing should also be inspected.

The Foxboro recording suction well gage found inoperative October 9, 1969. The instrument was returned to service by replacing capillary tubing and new rubber diaphragm. The instrument was recalibrated and placed in service.

Springfield Ave. Pumping Station

The new staff gage installed during September in the suction tunnel to unit No. 3, was checked for accuracy and the Foxboro recording well gage has been relocated in the gate shaft outside the station.

Tests were made January 14 on the two electric motor driven condensate pumps of Main Pumping Unit No. 1. Test results showed units to be in excellent condition. Failure of pumps to completely remove condensate was caused by an air leak.

Forty tubes of boiler No. 3 were checked October 8 with a "Turner Scale Thickness Indicator". Tubes checked were mostly those in primary contact with furnace heat. Most of the tubes were found to be clean but were spotty at bends. It was suggested these sections of tubes be given slightly more attention when cleaned.

Visual inspection on outside of primary tubes revealed no blisters.

Southwest Pumping Station

In June 1969, tests were made on the four main pumping units. The following shows a tabulation of overall efficiency from test curves at the units average pumping rate (mgd) for the year, 1968 at an average station log total head of 125.03 ft.

Unit No.	Pumpage (mgd) Specified	Pumpage (mgd) Average	Efficiency Percent Test 1969	Change in Efficiency* Percent Since Accept. Test	Change in Efficiency* Percent Since Last Major Repairs	Change in Efficiency* Percent Since Previous Test
1	50	63.1	83.8	-1.8	----	-1.4
2	50	62.7	82.9	-1.4	----	-0.7
3	50	63.3	84.0	-1.2	----	0.0
4	25	27.3	84.0	+0.4	----	-0.1

*There has been no major repairs since installation. Test results show little change in efficiency since installation of these units in 1963.

In September 1969, tests and observations of the pumpage head and electric horsepower were made on Vertical 50 mgd Unit No. 3. It was determined that unit had dropped 20% in capacity. Vibration analysis indicated the pump end to be at fault. The unit, when opened for inspection, showed a broken shaft coupling.

The diaphragm of the recording suction well gage was found collapsed. The diaphragm was replaced and instrument was recalibrated and returned to service October 21.

Thomas Jefferson Pumping Station

Tests were run on the four main pumping units on November 12th and 13th. Results are tabulated as follows:

Unit No.	Pumpage (mgd) Specified	Pumpage (mgd) Average	Efficiency* Percent Test 1969	Change in Efficiency Percent Since Accept. Test	Change in Efficiency Percent Since Last Major Repairs	Change in Efficiency Percent Since Previous Test
1	40	50.6	82.0	+4.5	+2.6	+6.5
2	40	50.6	83.4	+2.6	+2.5	+4.0
3	40	51.2	83.5	+4.0	+4.3	+4.1
4	40	52.9	84.7	+6.7	+5.0	+5.0

*From test curves at average pumping rate (mgd) 1968.

Test results indicated the overall efficiency was higher than at acceptance test or previous. Retests indicated the test data to be correct. All test instruments were calibrated and found correct. Test results indicated the electrical input to be in error by 2.8%.

It was recommended the meter board be inspected for possible loss in continuity. The switchgear is old and needs replacement.

Western Ave. Pumping Station

Tests were run on the four main pumping units on December 8, 9, 10, and 15. Results are tabulated as follows:

Unit No.	Specified Pumpage mgd	Specified Total Hd. ft.	Average* Pumpage Year 1968	Duty 1969 Test	Change in Duty Percent Since Accept. Test	Change in Duty Percent Since Last Major Repairs	Change in Duty Percent Since Previous Test
1	75	150	51.7	193.1	-2.0	-1.4	-0.8
2	75	150	51.5	205.4	-6.2	+2.1	+2.1
3	85	180	55.1	228.8	+1.3	----	+2.8
4	85	180	54.6	219.2	-0.1	----	-0.2

*Average station log total head of 111.4 ft for the year 1968.

The change in duty represents a change in efficiency. The increase in efficiency on unit No. 3 has resulted from replacing the turbine flange gasket.

Observations were made February 18 and 19 of the operation of the gas-oil conversion on boiler No. 3. Specifications state that combustion efficiency "shall be proved by testing the CO_2 contents of the flue gases when burning gas; a minimum of 9.5% shall be obtained. When burning #2 oil a minimum of 12% shall be obtained. Tests shall be run at 10,000, 20,000, 30,000 and 40,000 lbs of steam output per hour". Results of the tests show fuel burning equipment can maintain specified CO_2 burning either gas or No. 2 fuel oil.

Observations were made September 15th of boiler No. 4 furnace wall temperatures when gas fired and compared with results obtained December 12, 1968.

Date	12/12/68	9/15/69
Time	1:20 - 1:30 PM	12:30 - 1:30 PM
Steam Flow (#/lb)	41,750	30,900
Steam Temp (^oF)	575	590
Boiler Press (psi)	---	319
Furnace Draft ("H_2O)	0.13	0.05
Furnace Floor Temp (^oF)	2725	2120
Water Wall Temp (^oF)	2225	---

Results indicated a higher temperature quality brick should be specified for future coal to gas/oil boiler conversions.

Observations were made of No. 3 boiler tubes on September 19th for internal scale deposits with a turner scale thickness indicator. Boiler had been turbined prior to inspection.

Boiler tubes were found to have a light scale coating. Half of tubes in water wall, when inspected from fire box, were obviously bagged. Boilers No. 1, No. 2 and No. 4 showed no tube bags. It was concluded the boiler had received excessive heat following gas/oil conversion. This was attributed to flame outs and excessive heat generated when boiler was placed back on line. Since this boiler was the first converted at this station, the quickness of response over the companion coal fired boiler would account for this condition. The boilers operating condition has been corrected so as to reduce possibility of this again happening.

High vibration levels were reported on Main Pumping Unit No. 4 on August 20th. Vibration analysis made on this machine indicated level had increased 2.5 - 3.0 times over readings obtained October 22, 1968 pump tests. Vibration was originating in the turbine spindle-pinion gear end of unit. The unit, when shut down and inspected, revealed a loose coupling half on pinion and a damaged taper.

Following repairs vibration level had dropped back to that of 1968 pump tests.

Sound level measurements were made with a General Radio "Sound Survey Meter" type 1555A to check Fairbanks Morse Diesel Generator as specified under Specification and Contract Documents No. 80.71-68-2. Exhaust pipe on station roof generated noise below that specified. Measurements made within auxiliary room, where engine is located, gave sound levels exceeding those specified. It was recommended that means be found to reduce engine noise to an acceptable level and be within the specified conditions.

Manometer on reservoir was checked and corrected August 26.

Miscellaneous

Boiler water samples from all the boilers in service at the steam operated pumping stations and the Municipal Heating Plant were taken mid-monthly, tested and reported. The results with recommendations, from the pumping stations, were reported to the Pumping Station Operation Division, and the Municipal Heat Plant to the COE. These results included the pH of the condensate returns.

Tests were made at all steam stations for dissolved oxygen in boiler feed water as a check of deareating heater performance. Recommendations were made to improve heater performance. A pressure recorder was installed at Western Ave. Pumping Station to assist in maintaining heater pressure and temperature. Recommendations were made for the proper use of sulfite for additional chemical scavaging of dissolved oxygen.

Reserve coal supply at the five steam operated pumping stations was surveyed in the Spring and Fall. Corrections were made to station log figures of coal on hand and corrections made to "coal constant" where necessary.

Suction well recording gages at the pumping stations were checked periodically for accuracy and adjusted to read to 0.2 feet of correct well elevation.

The steam supplied to the three Park District Natatoriums was calculated, tabulated and submitted to the Operation Division monthly.

A study has been submitted to the Operation Division for improvement on boiler water sampling. It has been recommended a heat exchanger be placed on each boiler to cool sample down before being taken. This is as recommended by the American Society of Mechanical Engrs.

This section checks and approves all monthly electric bills for electric utility services to the Pumping Stations and Filtration Plants of the Bureau of Water.

Daily recording charts from all the Pumping Stations were examined as a check on performance and filed for future reference.

Venturi recorders, indicators, and integrators are being checked for accuracy. Results are reported to the COE of each station checked.

Tunnel surveys were made in August on the Chicago Ave. and the Wilson Ave. Tunnel Systems. Results of the surveys showed that the "Flow Head Loss" curves of 1968 are still valid.

CHARD J. DALEY
MAYOR

DEPARTMENT OF WATER AND SEWERS

BUREAU OF WATER

PUMPING STATION OPERATION DIVISION
811 N. MICHIGAN AVENUE
CHICAGO, ILLINOIS 60611

TELEPHONE 744-3677
744-3676
744-3675

JAMES W. JARDINE
COMMISSIONER

RAYMOND D. JOHNSON
DEPUTY COMMISSIONER
FOR WATER

ROBERT E. GLUCK
ASSISTANT ENGINEER
OF WATER PUMPING

1969 ANNUAL REPORT

PUMPING STATION OPERATION DIVISION

Nicholas H. Kuehn
Engineer of Water Pumping
(January 1st to October 31st)

Robert E. Gluck
Acting Engineer of Water Pumping
(November 1st to December 31st)

The Division operates and maintains eleven water pumping stations (including one automatically operated station), six water intake cribs, the water supply tunnels and shafts of the Chicago water works system, and the Hegewisch sewage pumping station which handles storm water.

OPERATIONAL DATA

The pumping stations in 1969 pumped a total of 373,575 million gallons (mil gal) or an average of 1,023 million gallons per day (mgd) of filtered water into the water distribution system. This was a decrease of 0.3% over 1968. The steam operated pumping stations pumped a total of 222,126 mil gal or 59.46% of the load and the electric operated pumping stations pumped 151,449 mil gal or 40.54% of the load.

The maximum pumpage during 1969 for a one day period was 1,619 mil gal on July 16. The maximum pumpage rate during the year occurred at 8:00 PM on July 16 when the stations delivered 2,180 mgd.

The stations were ordered on the summer pressure curve on May 28 at 11:00 AM and were ordered on the winter pressure curve at 10:00 AM on October 27.

Cribs

The William E. Denver Crib was on standby service while construction proceeded on the connection of the 20 ft raw water intake tunnel at the Central Water Filtration Plant to the Chicago Avenue tunnel lake section. The Edward F. Dunne Crib was the only active crib during 1969.

The screen for the Edward F. Dunne Crib were lowered on March 22 to protect against fish entry into the tunnel leading to the South Water Filtration Plant and were raised on November 30 to protect against ice formation which would block the intake to the tunnel.

Hegewisch Sewage Pumping Station

The Hegewisch Sewage Pumping Station was available to pump storm water as needed. During the year the station was in service for 28 days pumping a total of 38,681,400 gallons of storm water. The maximum pumpage of 4,700,000 gallons occurred on July 17.

PUMPING STATION WATER PRESSURE CONTROL

Western Avenue Pumping Station

In order to eliminate over pressurization in the distribution system during the early winter morning hours, the Western Avenue Pumping Station was ordered to operate on one pumping unit.

It was difficult to operate on one pump operation prior to gas conversion of boilers because of having to reduce the coal fired boiler plant load by having to "bank" one boiler. "Banking" a coal fired boiler is most difficult and could result in severe damage if not done properly. The advent of the gas fired boiler made it possible to reduce the plant steam load sufficiently to allow for reduced pumping unit capacity in service.

A second pumping unit normally is kept rolling on the turning gear so that it would be quickly brought into service should the one pump in service fail.

68th Street Pumping Station

A 16 inch discharge return line was installed on Unit No. 1 at the 68th Street Pumping Station for station pressure control. The return line was first used for normal operation on May 7 at midnight. The night station water pressure was maintained with no pump operating problems. This discharge return line will be used generally during the winter at night when the pumpage demand is low. With proper utilization of this discharge return line, the distribution system should not be overpressurized in the 68th Street area during the low demand period.

AIR POLLUTION CONTROL

In the program to eliminate sulphur dioxide and particulate matter emissions from the pumping stations, the conversions of the fuel burning equipment from coal to gas or No. 2 fuel oil continued to progress during the year and should be completed on schedule in 1972.

EQUIPMENT REPAIRS AND IMPROVEMENTS

Springfield Avenue Pumping Station

Springfield Avenue Pumping Station boiler conversions started in October 1969 with the conversion of Boiler No. 4. The contract for this work was awarded to Midwesco Enterprises, Inc. on a bid of $475,000. This contract included conversion of all four boilers to gas/oil fired package burner units manufactured by the Todd Burner Company. A small turbo generator furnishes electrical

power enabling operation of the flame safeguard controls and fuel trains for each conversion unit. In addition a 250 KVA diesel generator to re-start the plant in the event of both an Edison Company and Peoples Gas Company failure, the necessary air compressor capacity for air atomization of oil as well as two 30,000 gallon oil storage tanks are included in this conversion.

Western Avenue Pumping Station

The boiler conversion program at Western Avenue Pumping Station continued with the completion of Boiler No. 3 in February. Boiler No. 2 conversion is in progress and will be complete in early 1970. When Boiler No. 2 is complete and operating reliably then work will start on Boiler No. 1 at which time no more coal will be burned at this station.

During the first six months of operation on the boilers with their newly converted fuel burning equipment there were thirty-three recorded, unscheduled flame outs. One of the major causes of these problems was finally traced to an error in the original assembly of the conversion unit. The error was that the flame sensors were connected in series instead of parallel which meant that any loss of sight of the flame by one sensor or malfunction of one sensor would shut the boiler down. After this problem was detected and corrected, unscheduled flame outs were reduced to almost zero. During this period there was no interruptions of water service due to the ability of the coal boilers to pick up and carry the entire station load.

After Boilers 3 and 4 were converted to gas/oil firing and in service for some time, an inspection was made of Boiler No. 3 prior to starting the conversion of Boiler No. 2. This inspection showed that eleven tubes in the bridge wall were blistered just above the armor (Bernitz) blocks. Further inspection of these tubes showed severe corrosion especially the sections located within the armor blocks. It was necessary to replace these tubes before work could start on the conversion of Boiler No. 2. Inspection of the tubes in Boilers No. 1 and 2 also showed numerous blistered tubes which are being replaced as the conversion work is done. The probable cause of these blistered tubes was the shock loading of the boilers which stayed on the line during the recurring flame outs. As a protection against blistering of this type in the future the armor block protection of the tubes in the bridge wall will be built up two feet higher to cover the area where the damage was done.

Abnormal vibrations were noted on the turbine end of Pump No. 4. The gear cover was removed and it was found that the coupling on the pinion of the reduction gear had become loose. When the pinion was removed and inspected it was found that the keyway was damaged and there were surface cracks in the tapered end of the shaft. The gear teeth inside the coupling were badly worn and it was necessary to replace one half of the coupling. The damaged end of the pinion shaft was turned down slightly and the keyway was repaired.

The boiler feed pump, located in the auxiliary room, was moved to the boiler room adjacent to the other boiler feed pumps.

Central Park Avenue Pumping Station

Plans for fuel conversion at the Central Park Avenue Pumping Station have been completed and the contract should be awarded early in 1970. This contract includes the entire replacement of all five boilers with package

type gas/oil fired rated at 40,000 lbs. per hour each. The same electrical apparatus will be furnished as is described under Springfield Avenue Boiler Conversions.

A temporary steel stack installed in 1968 at the Central Park Avenue Pumping Station to allow for inspection of the station chimney, which had shown signs of extensive deterioration, required an induced draft fan to meet the draft requirements of the boiler plant during normal operation.

The inspection of the existing chimney indicated considerable interior damage to the radial brick lining and the recommendation made in the report of inspection by the Consolidated Chimney Company was to rebuild the upper portion of the chimney. The reconditioning of the chimney will be accomplished when the new plant is near completion and at such time when the old boilers will no longer be a factor in requiring the draft provided by the existing chimney.

In May when the check valve control for Pump No. 4 was disassembled for repairs and maintenance it was noted that the body of the 4 way control valve had deteriorated to a point where it could not be repaired in the station. This control was sent back to the Chapman Valve Company factory for rebuilding. The time estimated for rebuilding was 15 weeks.

In order to have this unit available for the 1969 summer load it was necessary to design a new control system from readily available stock items. This new control consisted of two Fisher 3 way valves which were set up to operate off the turbine first stage pressure. With the new control installed the unit was returned to service on June 27.

During the year there were three auxiliary oil pump failures on main Unit No. 4 and one oil pump failure on Unit No. 5. These oil pumps are small turbine driven units which supply oil to the governor and lubrication systems when the main oil pump is not providing adequate pressure. Two of the failures on Unit No. 4 were caused by low oil level which allowed the oil pump to run away and the excessive speed ruined the steam turbine. The third failure on Unit No. 4 was caused by erosion in the nozzle ring which allowed a run away condition. The failure on Unit No. 5 occurred when the oil diaphragm in the steam pressure regulator ruptured, after a faulty repair, allowing oil to be pumped out of the unit until a low oil level prevailed. The pump was not properly primed and excessive speed ruined the turbine. Unit No. 5 has been repaired with no further problems. On Unit No. 4 oil level in the overhead storage tank has been reduced to increase the level in the unit reservoir and it is planned to replace this turbine oil pump with an electric gear pump to eliminate any possible future problems in this area.

Chicago Avenue Pumping Station

Modifications were made to tunnel shafts J, K and M necessitating relocation of the well elevation gage formerly located in Shaft J. A new gage was installed in Shaft N and the well elevation recorder was placed in the East pump room.

Mayfair Pumping Station

During 1969, the new 78 inch concrete discharge pressure tunnel at Mayfair Pumping Station was completed. The tunnel was sterilized and placed in operation on September 8.

During the year two new 180,000 lb. per hour deaerating heaters, were designed, purchased and installation started. This enlarged equipment will allow the station to operate on one heater during the peak summer loading conditions.

A new boiler feed pump rated at 350 gal/min. will be installed in 1970 to replace one of the old steam turbine driven pumps.

Electric motor driven condensate pumps were installed to replace one water turbine driven pump on each of Units No. 1 and 2.

Roseland Pumping Station

A pitometer operated Chapman 4-way valve control replaced the Davis control which operated off the first stage steam pressure on Unit No. 4. The advantages of the pitometer operation are that (1) the pump may be operated at low pumpages to maintain night pressure requirements and (2) should the turbine shaft fail, the pump discharge valve would close immediately rather than continue to remain open as would be the case if it were connected to the first stage turbine pressure.

A new electric motor drive was installed on one condensate pump of Unit No. 2 to make this unit more reliable at times of low station operating pressure when there is not sufficient head to operate the water turbine. New electric motor drives will also be installed on condensate pumps for Units No. 1 and 2A in 1970.

A new venturi register of 130 mgd capacity was installed on Unit No. 1 to totalize the flow through the discharge main when Unit No. 2 plus Unit No. 1 is discharged to the East through the same main.

68th Street Pumping Station

Problems were experienced in operating the electric ball discharge valve on Unit No. 3. An internal inspection of the valve revealed that the downstream seat had pulled away from the plug. Upon examination it was noted that the plug was not threaded for the ring in the original manufacture which was shown on the drawing. This being the downstream seat it was not necessary for sealing against a back flow of water from the street. This seat was removed and the unit was returned to service with no additional repairs necessary.

An overhead beam and hoist were installed in the south end of the boiler room at the garage doors to help in unloading supplies and equipment delivered to the station.

Southwest Pumping Station

On September 9 it was reported that Unit No. 3 was not delivering at full capacity. The Pumping Station Efficiency Section made a capacity-head test on the Unit and found that it was operating much below its most recent test condition. It was thought that there might be some blockage in the impeller of the pump. The City diver was sent down to investigate. The diver indicated he could find no foreign matter in the pump.

After the above mentioned investigations showed no reasons for the reduced operating condition it was decided to dismantle the unit for inspection.

During the disassembly the problem became apparent. When the motor and the top three pump sections were removed it was discovered that one of the shaft couplings had broken through its thrust nut allowing the impellers to drop and ride against the pump bowls. The abrasion of the impellers riding against the bowls wore approximately 2 5/8 inches off the ends of the blades. This wear accounted for the reduced capacity of the pump. The exact cause of this failure is still under investigation. Repairs are being made and this unit should be ready for the summer 1970 load.

A new design for a four way valve control, manufactured by Bellows-Valvair, promises to provide the necessary requirements for the operation of the hydraulic ball discharge valve in order to maintain the specified station water pressure curve. A previous newly designed 4 way valve control that was installed on Unit No. 4 has operated very well. The new control, already purchased, is an improvement over the original design and will be used for operation of the Hydraulic discharge valve on Unit No. 3.

The problem with the old Willamette 4 way valve control at Southwest, provided with the original pump installation, was that the ball discharge valve would drift to a closed position when pumpage was throttled.

Springfield Avenue Pumping Station

When Unit No. 1 was returned to service after the new 9 ft tunnel was completed it was found that the hydraulic check valve was stuck in the closed position. It was necessary to arrange for a high pressure source of water from the boiler room (150 psi) and apply the pressure to the hydraulic cylinder and also place a 12 ton jack under the piston rod in order to free this valve which was wedged in the seat. A new stop was installed so that the piston will not be able to over travel and wedge this valve again.

With the removal of the center well from the station it was necessary to relocate the suction well recorder. A new gage was installed in the new 16 ft gate shaft.

The electrical controls for the overhead crane in the pump room were rebuilt. New magnetic controls for the hoist, bridge and trolly motions were installed.

Thomas Jefferson Pumping Station

A failure of the trunion on the hydraulic cone valve for Pump No. 3 occurred in June. The trunion, which had sheared off at the plug, was replaced and Pump No. 3 was returned to service.

Lake View Pumping Station

A new 24 volt DC Power Supply was installed to increase reliability in the Bristol Board. This gave the constant voltage that these components needed to function properly. Previous to this, erratic voltages caused consistent malfunction of components.

Western Avenue Pumping Station

In order that the Reservoir chlorine residual could be monitored during its operational and standby periods, a test cell was installed in the Reservoir vault to test for chlorine residual and then record the results on a Leeds

and Northrup Micromax recorder in the pump room of the station. The Micromax recorder for the Reservoir was placed in service at 11:00 AM on July 23.

A new passenger elevator was purchased and is in the final stages of installation in the pump room to replace the old Otis elevator.

BUILDING REPAIRS AND IMPROVEMENTS

Chicago Avenue Pumping Station

The Chicago Water Tower and the Chicago Avenue Pumping Station are built of Joliet Limestone which is continuously subjected to erosion caused by the high concentration of sulfur dioxide in the atmosphere and the combination of oxygen and water reacting with the sulfur dioxide.

Test patches were allocated to Dr. Seymour Z. Lewin of New York University on the Water Tower for evaluation of a special limestone preservative formula. Liquid silicon dioxide (SiO_2) is applied to highly porous limestone. When the SiO_2 solidifies it forms a quartz shield for the stone surface, reduces the porousity, and thus prevents any significant deterioration of the stone. Since Joliet Limestone is no longer being mined and maintenance of these stations is a continuing problem, this new formula could reduce costs while preserving the structures.

On November 19 after a sizable piece of the drip cap (approx. 200 lbs) over the east door fell to the sidewalk an inspection of the lower portion of the Water Tower was made. This inspection revealed severe cracking in the drip cap over the north door. At the present rate of deterioration extensive repairs will be necessary in the near future if some method cannot be found to slow down the masonry erosion.

Central Park Avenue Pumping Station

Masonry repairs were made to the inside face of the south and east parapet wall of the storage room. The inside face was repaired with new pressed face brick. After completion of the repairs the existing roofing over the storage room was replaced with a new 5 ply built up steep asphalt and gravel roof including installation of copper counter flashing.

68th Street Pumping Station

Masonry repairs were made to the parapet wall at the south end of the pump room which included new face brick and new coping.

Springfield Avenue Pumping Station

Repairs were made to pump room downspouts to renew deteriorated piping.

The old chlorine building was remodeled in order to provide the storage facilities needed to replace those eliminated to make way for the new diesel generator.

Roofing was renewed over the machine shop which included a new 5 ply built up pitch and gravel roof, new copper counter flashing and celotex block insulation.

Masonry repairs were made to include rebuilding the 4 ft high parapet wall of the storage building using face brick for the inside face.

The pump room windows in the east and south walls were adapted for new mechanically operated windows.

Roseland Pumping Station

The roofing over the boiler room and storage room was renewed with 5 ply built up steep asphalt and gravel including celotex block insulation. The copper counter flashing will be installed in 1970.

Prior to the above mentioned roofing work, some repairs to the inside face of the parapet wall of the boiler room were made which included replacing approximately 600 sq ft with face brick.

Western Avenue Pumping Station

Repairs were made to the station downspouts which included two new downspouts on the west wall of the auxiliary room at the north east and south east corners and a pipe header at the west wall of the pump room tieing into four downspouts on the wall.

The boiler room addition, which formerly housed Boiler No. 5 was remodeled for use as a steamfitters shop. The remodeling work consisted of new permanent electrical wiring to present flourescent fixtures and to two existing unit heaters.

STATION SECURITY

Continued improvements were made or planned in station security during the year. Central Park Avenue Pumping Station tightened the security around the station by making improvements to the existing chain link fence which previously had been breached quite often by vandals. The use of extended barb arms and concertina wire has become an effective deterrent. 68th Street Pumping Station will have improved security at the east end and have protective screening on the station windows. A chain link fence in the area east of the Thomas Jefferson Pumping Station has been constructed to discourage vandalism. A rolling steel door has been installed at Southwest Pumping Station at the north end to allow for pump room ventilation and provide station security at the same time.

NEW TUNNEL CONSTRUCTION

Springfield Avenue Pumping Station

During 1969 the new 9 ft water supply tunnel supplying water to Pumps No. 1, 2 and 3 was completed. Final tunnel connections to these Units necessitated taking the individual Pump out of service by closing the suction sluice gate at the old center wet well. Unit No. 3 was equipped with a 60 inch butterfly valve in the 6 ft tunnel section so that this Unit will be able to be supplied from either the old 8 ft brick tunnel through its original suction gate, or through the new tunnel. The suctions to Units No. 1 and 2 have been closed off from the center wet well by bulkheads and these pumps will receive water only from the new tunnel. The removal of the wet well in the center of the station began in October. Units No. 4 and 5 will be out of service until the wet well is capped with concrete.

On May 7 the temporary bulkhead was removed from the 15 ft gate shaft allowing the new 9 ft and 6 ft tunnels to Units 1, 2 and 3 to be flooded. Unit No. 2 was placed in service, after the new tunnel was flooded and sterilized, at 1:30 PM on May 8.

TUNNEL SHAFT ALTERATIONS

Work involving removal of chlorine conduits, hoses and steel work from the shafts was completed at the various pumping stations supplied from the Chicago Avenue Tunnel System (Chicago Avenue, Cermak, Springfield Avenue and Central Park Avenue) and the Wilson Avenue Tunnel System (Mayfair) during 1969. In addition, horizontal reinforced concrete caps were placed on Shafts J and K at Chicago Avenue and a vertical concrete bulkhead with provisions for a 16 inch discharge return line was installed in Shaft M. At Cermak Pumping Station the chlorination shaft was sealed with concrete.

COAL SHIPMENTS

Coal was ordered in 1,000 ton shipments during the year. The coal, which was oil treated for the first time in 1967, continued on oil treatment in 1969. At Western Avenue Pumping Station, due to their reduced storage area and reduced coal usage, coal was not received in 1,000 ton lots. Springfield Avenue Pumping Station stopped receiving 1,000 ton lots in October when their storage area was reduced to make way for the new 30,000 gallon capacity oil storage tanks in the old coal storage pit. The pumping stations ordered a total of 107,894 tons. As usual, there was a savings in freight cost amounting to $0.50 per ton by ordering in 1,000 ton lots.

During the year there were 94 lots of coal over 1,000 tons amounting to 97,300 tons which accounted for a saving in freight costs of $48,649.98.

ELECTRICAL OUTAGES

Springfield Avenue Pumping Station

At 5:10 AM on July 17 on Edison failure occurred. The emergency steam driven air compressor was placed in service at 5:15 AM to provide air for the combustion controls. The hydraulic link grate drive on the stokers which is electrically driven, necessitated moving the fire bed manually. At the time of this failure the station generator was out of service because of scaffolding placed around it to work on the overhead crane. The scaffolding was removed and the generator started at 6:00 AM. Edison service was restored at 7:30 AM.

Lake View Pumping Station

On August 23, Edison was given permission to take electrical supply lines 1434 and 1441 out of service for routine maintenance. While line 1441 was out of service line 1434 tripped out caused by a voltage dip at the Edison Northwest Generating Station No. 1 pump was tripped out of service at this time and the station pressure dropped from 50 psi to 42 psi.

When the Lake View pumping station is on one source of supply for electrical power the immediate effect of losing the one electrical supply line is that the line breaker must be manually closed in at the Lake View Pumping Station as it cannot be remotely operated from Thomas Jefferson and no pumping units

can be operated until this is done. The station tripped out at 6:42 PM on August 24 and was put back in service at 8:15 PM when Edison completed their work.

On August 27 while routine repairs were being made at the station necessitating line 1434 to be out of service, another voltage dip occurred at Northwest Generating Station causing line 1441 to trip. The station was down from 9:18 AM to 9:30 AM.

On October 23 main electrical supply Line No. 1441 failed at 12:30 PM because of a cable problem on the Edison side. Unit No. 3 is serviced from this line and was operating at the time of failure. Unit No. 1 which is serviced from Line No. 1434 stayed in service. A water pressure drop from 48 to 33 psi occurred. Unit No. 2 was started immediately and the pressure was back to 48 psi by 12:40 PM.

Southwest Pumping Station

On February 17 an explosion in an Edison Transmission Line caused electrical supply lines 3335 and 3350 to fail shutting down this pumping station. Units No. 2 and 4 were in service at the time. Unit No. 2 was returned to service 5 minutes after the failure. Unit No. 4 was back 5 minutes after Unit No. 2. On three occassions one of the main electrical supply lines or the other was out of service but did not cause an interruption of water service. These failures occurred on June 30 for 3 hours 25 minutes, July 17 for 2 minutes, July 26 for 1 minute.

Cermak Pumping Station

The station failed January 8 at 10:40 AM because of a multiple phase fault in electrical supply line No. 1144 (Transformer No. 1) caused by a fire at the Fiske Generating Station of the Commonwealth Edison Company, Line No. 1945 attempted to backfeed into line 1144 and this caused the line voltage to drop from 2370 to 1900 volts. The reverse current relay failed to cut the faulty line away from the station in time and motors for Units No. 4 and 5 tripped out on the undervoltage relays. Moments later the Edison warning light and horn were activated on the switchboard indicating that Transformer No. 1 had opened up. The Edison load dispatcher was notified of the station failure at 10:50 AM. When Transformer No. 1 opened up, the line voltage recovered in line No. 1945 allowing Units to be restarted. Unit No. 4 was back in service at 10:51 AM and Unit No. 5 was back in service at 10:54 AM. A meeting was held with Edison Engineers to discuss adjustments in the reverse current relays for added reliability.

68th Street Pumping Station

On September 4, Line 1544 tripped out at 12:30 PM caused by a problem on the Edison side. The cone valve for Unit No. 6, in service at the time of failure, closed half way. There was no drop in station pumpage or pressure at the time of failure. The other electrical supply line (83432) normally in service with line 1544 was not interrupted. Power was restored to line 1544 and it was back in service at 1:30 PM.

HEGEWISCH SEWAGE PUMPING STATION

During 1969, one new natural gas Ford 4 cylinder engine drive (40 hp unit) was installed for Pumping Unit No. 2 which has been in service since 1909.

CRIBS

On November 28 while the contractor was making the tunnel connection into the 16 ft lake section of the Chicago Avenue Tunnel for the 20 ft raw water tunnel to the Central Water Filtration Plant the 2300 volt 3 phase line which supplies the Harrison Crib was punctured. The puncture in the cable shorted 2 phases and blew two 40 amp 2300 volt fuses which left the Harrison-Dever Cribs and Wilson Avenue Crib (which is supplied from Harrison) without electrical power. This electrical supply cable encased in the concrete lining of the Chicago Avenue tunnel in the south invert has been in service since 1936. Repairs were made by splicing and the cable returned to service on December 3. Some dampness had entered the cable prior to the splice and this could create future problems.

During the year equipment and building repairs were made to maintain these important lake structures in serviceable condition.

The Carter H. Harrison Crib had repairs made to the deteriorated portion of the steel shell encircling the crib exterior, the concrete landing dock and to the masonry which included replacement of deteriorated brick and tuck-pointing where needed. The boiler room on the first floor was rewired which included replacing the branch circuit distribution panels. The waste water tanks were replaced. The heating system was overhauled which included replacement of faulty traps and sealing valve leaks. The crossover bridge between the Harrison and William E. Dever Crib was repaired where needed which included replacing the wooden deck and six wooden stringers. The wooden derrick used to load and unload supplies and equipment from the City tug was rebuilt.

The 68th Street Crib had electrical work accomplished which included rewiring the circuits in the bedroom and kitchen, providing more lighting and outlets where necessary. A new cast iron hand fired boiler rated at 400,000 Btu/hr was installed. A new 4 inch steam line was also installed. Masonry work accomplished during the year included tuckpointing of exterior stone work. The steel bridge deck between the Crib and the dock was renewed.

Considerable masonry work was completed on the Edward F. Dunne Crib which included repairing the badly deteriorated concrete in the exterior wall and stairs leading to the well room entrance. Steel lintels were replaced over two windows in the well room exterior wall and brickwork, where deteriorated, was replaced with new brick.

An effort was made to repair the landing dock of the Wilson Avenue Crib which required replacing 5 sections of sheet steel piling that had become displaced. However, bad weather continually thwarted this project.

FACILITIES IN SERVICE 1969

CRIBS

Edward F. Dunne Sixty-Eight Street (Deactivated)	Thomas Ward	Head Crib Keeper
Four Mile*		
William E. Dever* Carter H. Harrison (Deactivated)		
Wilson Avenue*		

*Standby service. Dever Crib will be reactivated when the tunnel connection between the Central Water Filtration Plant and the Lake Section of the Chicago Avenue Tunnel is constructed.

TUNNELS

Wilson Avenue South Side Land System	Chicago Avenue Blue Island Avenue	North Lake Shore Four Mile - Polk St.*

*Standby service.

WATER PUMPING STATIONS

STATION	ADDRESS	CHIEF OPERATING ENGINEERS
Central Park Avenue	1015 S. Central Park Ave.	Carl M. Saunders
Cermak	735 W. Harrison St.	Daniel G. Butler
Chicago Avenue	811 N. Michigan Ave.	Eugene J. Lockwood
Thomas Jefferson	2250 W. Eastwood Ave.	James T. Jardine
Lake View	745 W. Wilson Ave.	James T. Jardine
Mayfair	4850 W. Wilson Ave.	Edward T. Nepyjwoda
Roseland	351 W. 104th St.	Edward E. Carlson
Sixty-Eight Street	6801 S. Oglesby Ave.	James K. Rowan
Southwest	8400 S. Kedvale Ave.	Anthony J. Perroni
Springfield Avenue	1747 N. Springfield Ave.	Edward J. Conroy
Western Avenue	4933 S. Western Ave.	Robert E. Nolan

SEWAGE PUMPING STATION

Hegewisch	2929 E. 134th Street	Walter J. Trzeciak

WATER PUMPING STATIONS MONTHLY PUMPAGE IN MILLION GALLONS - 1969

MONTH	LAKE VIEW	THOMAS JEFFER-SON	MAY-FAIR	CHICAGO AVENUE	CERMAK	CENTRAL PARK AVENUE	SPRING-FIELD AVENUE	SIXTY-EIGHT STREET (1)	ROSE-LAND	WESTERN AVENUE (2)	SOUTH-WEST	TOTAL
Jan.	1,251	1,118	3,864	2,404	2,554	3,867	3,136	1,849	3,586	2,899	2,566	29,094
Feb.	549	1,820	2,808	2,136	2,246	3,274	3,418	1,669	3,270	2,432	2,228	25,850
March	289	2,459	3,287	2,310	2,432	3,829	3,072	1,830	3,853	2,715	2,196	28,272
April	1,059	1,458	3,451	2,356	2,449	3,756	2,974	1,814	3,794	2,609	2,145	27,865
May	1,128	1,503	3,853	2,524	2,591	4,220	3,741	2,028	4,127	2,870	2,268	30,853
June	786	2,000	3,838	2,509	2,577	4,069	4,383	2,804	3,978	2,703	2,531	32,178
July	882	2,221	4,675	3,084	3,243	4,446	4,761	3,185	4,345	3,401	2,954	37,197
Aug.	958	2,328	5,767	3,073	3,739	4,574	4,977	3,448	4,933	3,787	3,374	40,958
Sept.	882	1,693	4,713	2,510	3,044	4,080	4,357	2,758	4,088	2,895	2,962	33,982
Oct.	1,096	1,313	4,726	1,824	3,280	4,552	3,301	2,200	3,732	2,276	2,865	31,165
Nov.	1,215	1,207	3,919	1,617	2,545	4,127	2,887	1,784	3,399	2,394	2,642	27,736
Dec.	1,282	1,247	3,987	1,590	2,661	4,119	3,014	1,773	3,487	2,731	2,534	28,425
TOTAL	11,377	20,367	48,888	27,937	33,361	48,913	44,021	27,142	46,592	33,712	31,265	373,575
DAILY AVG.	31.17	55.80	133.94	76.54	91.40	134.01	120.61	74.36	127.65	92.36	85.66	1023.49

NOTE: (1) May 105.5 MG recirculated at 68th Street Pumping Station not included in month total.
(2) In addition to the above, Western Avenue Station pumped to its reservoir the following quantities: May 35 MG; June 305 MG; July 409 MG; August 390 MG September 231 MG; October 514 MG; November 42 MG; TOTAL 1,926 MG not included in above totals.

COAL ACCOUNTS - WATER PUMPING STATIONS - 1969

CENTRAL PARK AVENUE PUMP STATION	TONS	PRICE PER TON	COST
On Hand January 1, 1969	2,586	$ 7.896	$ 20,419.06
Total Received	23,399	8.065	188,718.52
Total Available	25,985	8.048	209,137.58
Total Consummed	23,816	7.998	190,484.18
On Hand December 31, 1969	2,169	8.600	18,653.40
SPRINGFIELD AVENUE PUMP STATION			
On Hand January 1, 1969	3,441	$ 7.896	$ 27,170.14
Total Received	21,587	8.136	175,624.33
Total Available	25,028	8.103	202,794.47
Total Consumed	22,692	8.116	184,162.53
On Hand December 31, 1969	2,336	7.976	18,631.94
ROSELAND PUMPING STATION			
On Hand January 1, 1969	4,723	$ 7.896	$ 37,292.81
Total Received	27,835	8.236	229,240.61
Total Available	32,558	8.186	266,533.42
Total Consumed	29,048	8.074	234,525.45
On Hand December 31, 1969	3,510	9.119	32,007.97
MAYFAIR PUMPING STATION			
On Hand January 1, 1969	3,080	$ 7.896	$ 24,319.68
Total Received	28,084	8.101	227,507.56
Total Available	31,164	8.081	251,827.24
Total Consumed	28,966	7.985	231,296.89
On Hand December 31, 1969	2,198	9.340	20,530.35
WESTERN AVENUE PUMPING STATION			
On Hand January 1, 1969	1,253	$ 7.896	$ 9,893.69
Total Received	6,989	8.086	56,514.34
Total Available	8,242	8.057	66,408.03
Total Consumed	7,891	8.038	63,425.93
On Hand December 31, 1969	351	8.496	2,982.10

TOTAL OF COAL ACCOUNTS - FIVE PUMPING STATIONS

	TONS	PRICE PER TON	COST
On Hand January 1, 1969	15,083	$ 7.896	$119,095.38
Total Received	107,894	8.134	877,605.36
Total Available	122,977	8.105	996,700.74
Total Consumed	112,413	8.041	903,894.98
On Hand December 31, 1969	10,564	8.785	92,805.76

ELECTRIC POWER ACCOUNTS - WATER PUMPING STATIONS

STATION	KW HOURS*	COST
Chicago Avenue	14,800,000 (1)	$158,536.53
68th Street	13,928,000 (2)	148,737.98
Thomas Jefferson	10,107,780	111,069.04
Cermak	14,435,200	159,051.35
Southwest	19,905,600	204,437.47
Lake View	5,248,000	66,062.31
TOTAL ELECTRIC PUMPING STATIONS	78,424,580	$847,894.68

*Taken from Electric Bills

(1) Includes 50,687 kwhr furnished to Fire Department, Cribs and Water Tower at a cost of $554.27.

(2) Includes 60,500 kwhr furnished to 68th Street and Dunne Cribs at a cost of $652.75.

WATER PUMPING STATIONS
PUMPING EQUIPMENT IN OPERATION - DECEMBER 31, 1969
ELECTRICALLY DRIVEN PUMPS

STATION	PUMP NO.	YEAR INSTALLED	CENTRIFUGAL PUMP				MOTOR - (ALL 2300V - 3 PHASE A.C.)*		
			RPM	CAPACITY MGD	HEAD FEET	MANUFACTURER	H.P.	TYPE	MANUFACTURER
Chicago Avenue	1	1920	710	40	130	DeLaval	1200	Wound Rotor	General Electric
	2	1920	710	40	130	DeLaval	1200	Wound Rotor	General Electric
	3	1921	710	40	130	DeLaval	1200	Wound Rotor	General Electric
	4	1921	710	40	130	DeLaval	1200	Wound Rotor	General Electric
	5	1957	514	50	140	DeLaval	1500	Synchronous	Fairbanks-Morse
	6	1957	514	50	140	DeLaval	1500	Synchronous	Fairbanks-Morse
Cermak	1	1935	514	50	136	Allis-Chalmers	1500	Synchronous	Westinghouse
	2	1935	514	50	136	Allis-Chalmers	1500	Synchronous	Westinghouse
	3	1935	514	50	136	Allis-Chalmers	1500	Synchronous	Westinghouse
	4	1935	514	50	136	Allis-Chalmers	1500	Synchronous	Westinghouse
	5	1935	514	50	136	Allis-Chalmers	1500	Synchronous	Westinghouse
	6	1935	514	50	136	Allis-Chalmers	1500	Synchronous	Westinghouse
Thomas Jefferson	1	1928	590	40	150	Fairbanks-Morse	1200	Wound Rotor	General Electric
	2	1928	590	40	150	Fairbanks-Morse	1200	Wound Rotor	General Electric
	3	1928	590	40	150	Fairbanks-Morse	1200	Wound Rotor	General Electric
	4	1928	590	40	150	Fairbanks-Morse	1200	Wound Rotor	General Electric
Lake View	1	1967	720	35	130	Worthington	900	Synchronous	Elec. Machinery
	2	1967	720	35	130	Worthington	900	Synchronous	Elec. Machinery
	3	1967	720	35	130	Worthington	900	Synchronous	Elec. Machinery
68th Street	1	1959	514	50	145	DeLaval	1500	Synchronous	Fairbanks-Morse
	2	1960	514	50	145	DeLaval	1500	Synchronous	Fairbanks-Morse
	3	1957	514	50	145	DeLaval	1500	Synchronous	Fairbanks-Morse
	4	1945	514	50	145	Allis-Chalmers	1500	Synchronous	Westinghouse
	6	1949	514	50	145	DeLaval	1500	Synchronous	General Electric
(1) Southwest	1	1963	600	50	215	Byron-Jackson	2250	Synchronous	Elec. Machinery
	2	1963	600	50	215	Byron-Jackson	2250	Synchronous	Elec. Machinery
	3	1963	600	50	215	Byron-Jackson	2250	Synchronous	Elec. Machinery
	4	1963	900	25	215	Byron-Jackson	1250	Synchronous	Elec. Machinery

(1) All pumps at Southwest are two stage vertical circulating type.

*Note: All motors at Southwest Pumping Station operate using 4360 volts - 3 Phase A.C.
All motors at Lake View Pumping Station operate using 4160 volts - 3 Phase A.C.

WATER PUMPING STATIONS

PUMPING EQUIPMENT IN OPERATION - DECEMBER 31, 1969

STEAM TURBINE DRIVEN GEARED CENTRIFUGAL PUMPS

STATION	PUMP NO.	YEAR IN-STALLED	CENTRIFUGAL PUMP				HIGH PRESSURE CONDENSING STEAM TURBINE				
			RPM	CAPACITY MGD	HEAD FEET	MANUFACTURER	H.P.	RPM	STEAM PRESS.	STAGES	MANUFACTURER
Central Park Avenue	1	1955	535	60	167	DeLaval	2013	3890	175	15	DeLaval
	2	1958	535	60	167	Worthington	2030	4032	175	12	Worthington
	3	1957	416	80	167	Worthington	2695	3599	175	13	Worthington
	4	1936	430	80	165	Worthington	3145	3400	175	15	General Elec.
	5	1950	430	80	165	Worthington	3050	3600	175	15	Worthington
Spring-field Avenue	1	1955	535	60	167	DeLaval	2013	3890	400	20	DeLaval
	2	1958	426	80	167	DeLaval	3100	3830	400	20	DeLaval
	3	1960	530	60	167	DeLaval	2000	3840	400	20	DeLaval
	4	1938	440	80	167	DeLaval	3100	3635	400	20	DeLaval
	5	1947	426	80	167	DeLaval	3100	3530	400	15	DeLaval
Roseland	1	1944	460	75	215	DeLaval	3200	3690	375	20	DeLaval
	2	1956	715	40	230	DeLaval	1857	5832	375	10	DeLaval
	2A	1956	715	40	230	DeLaval	1857	5832	375	10	DeLaval
	3	1949	460	75	215	DeLaval	3200	3928	375	15	DeLaval
	4	1954	460	75	215	DeLaval	3225	3920	375	15	DeLaval
Western Avenue	1	1927	530	75	150	DeLaval	2440	4417	300	10	General Elec.
	2	1927	530	75	150	DeLaval	2330	**	300	14&10	DeLaval
	3	1960	450	85	180	DeLaval	3032	3935	300	20	DeLaval
	4	1959	435	85	180	Worthington	3090	3763	300	13	Worthington

*No. 1 Turbine installed in 1952.

**No. 2 Turbine is compound: High Pressure rotor, 4450 rpm.
Low pressure rotor, 3205 rpm.

WATER PUMPING STATIONS

PUMPING EQUIPMENT IN OPERATION - DECEMBER 31, 1969

STEAM TURBINE DRIVEN GEARED CENTRIFUGAL PUMPS (Continued)

STATION	PUMP NO.	YEAR IN-STALLED	CENTRIFUGAL PUMP				HIGH PRESSURE CONDENSING STEAM TURBINE				
			RPM	CAPACITY MGD	HEAD FEET	MANUFACTURER	H.P.	RPM	STEAM PRESS.	STAGES	MANUFACTURER
Mayfair	1	1932	556	60	235	DeLaval	2900	*	200	14 & 9	DeLaval
	2	1932	556	60	235	DeLaval	2900	*	200	14 & 9	DeLaval
	3	1961	480	80	235	DeLaval	3697	3970	200	19	DeLaval
	4	1961	480	80	235	DeLaval	3697	3970	200	19	DeLaval
	6	1954	565	60	235	DeLaval	2823	3940	200	15	DeLaval
	7	1954	565	60	235	DeLaval	2823	3940	200	15	DeLaval

*No. 1 and No. 2 turbines are compound: High pressure rotor, 4620 rpm;
Low pressure rotor, 3534 rpm.

SUMMARY OF PUMPING EQUIPMENT

Electrically driven pumps ... Total 28 Capacity 1250 MGD

Steam driven pumps ..... Total 25 Capacity 1745 MGD

All available pumps ..... Total 53 Capacity 2995 MGD

WATER PUMPING STATIONS

STEAM GENERATING EQUIPMENT IN OPERATION DECEMBER 31, 1969

LOCATION	BOILER EQUIPMENT	FUEL BURNING EQUIPMENT	CHIMNEY
WESTERN AVENUE PUMPING STATION	Four Wickes: 654 hp, 4 drum bent tube type,6545 sq ft surface, 3¼" tubes, 890 sq ft superheater, and water tube rear furnace wall. Steam Conditions: 325 psi, 225°F superheat (400 psi Design Pressure) Installed #1-1956; #2-1957; #3-1955; #4-1954.	Two - Westinghouse: 6 retort turbine driven underfeed coal stokers-with hydraulic driven overfeed section and 2 turbine driven forced draft fans. Two Engineering Co. Gas and Oil fired package burner unit (BLR#4) complete with 30 hp electric motor driven forced draft fan.	One 8'3" top dia. 217 ft high Radial brick (1926)
ROSE-LAND PUMPING STATION	Four Edgemoor: 615 hp, 4 drum bent tube type, 6150 sq ft surface, 3¼" tubes, 600 sq ft superheater, and water tube rear furnace wall. Steam Conditions: 385 psi, 200°F superheat (400 psi Design Pressure) Installed #1-1943; #2-1942; #3-1948; #4-1946.	Four Westinghouse: 6 retort turbine driven underfeed coal stokers-with hydraulic driven overfeed section and 4 turbine driven forced draft fans.	One 11'0" top dia. 265 ft high Radial brick (1960)
MAYFAIR PUMPING STATION	Six Wickes: 513 hp, 4 drum bent tube type, 5130 sq ft surface, 3¼" tubes, 498 sq ft superheater, and water tube rear furnace wall. Steam Conditions: 235 psi, 210°F superheat (300 psi Design Pressure) Installed #1-1956; #2-1957; #3-1959; #4-1960; #5 and #6-1958.	Six American Engineering: 5 retort hydroelectric or steam driven underfeed coal stokers-with hydraulic driven overfeed section and six turbine driven forced draft fans.	One 11'0" top dia. 285 ft high Radial brick (1956)

WATER PUMPING STATIONS

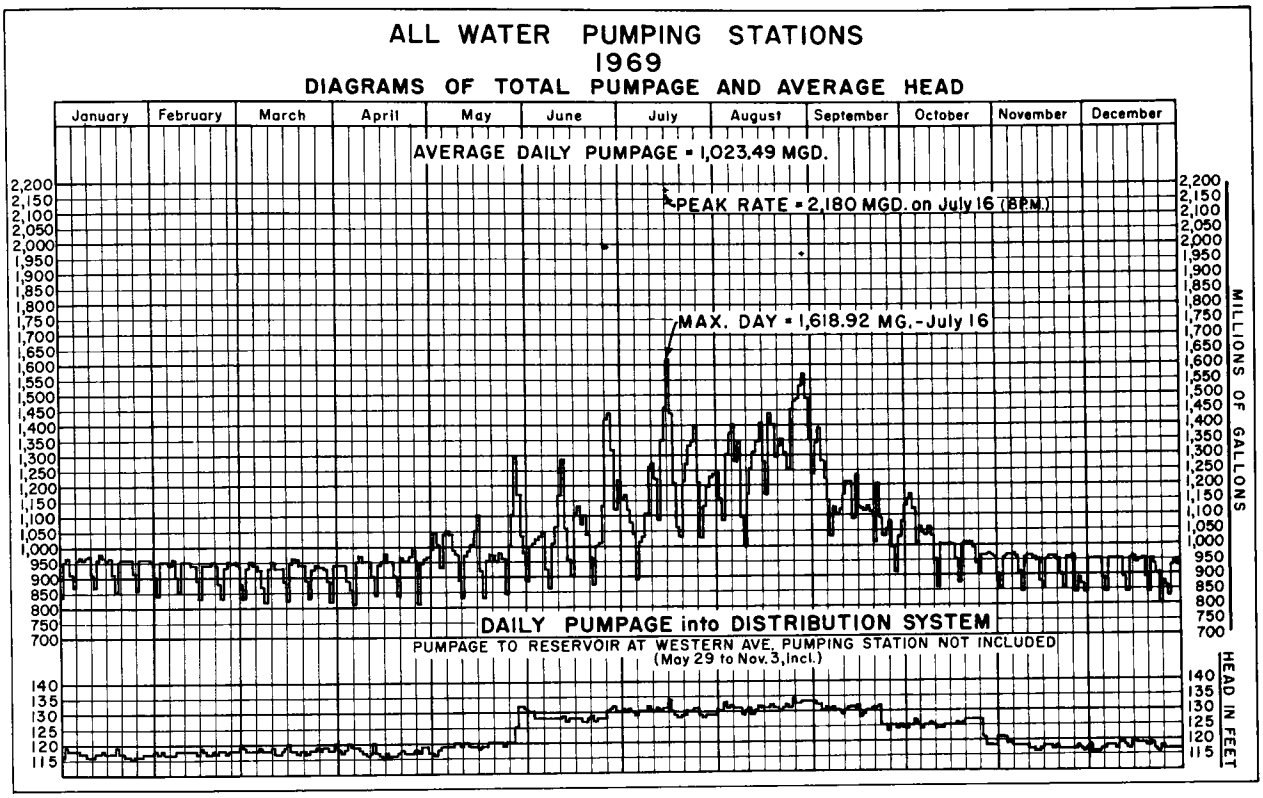
STEAM GENERATING EQUIPMENT IN OPERATION DECEMBER 31, 1969

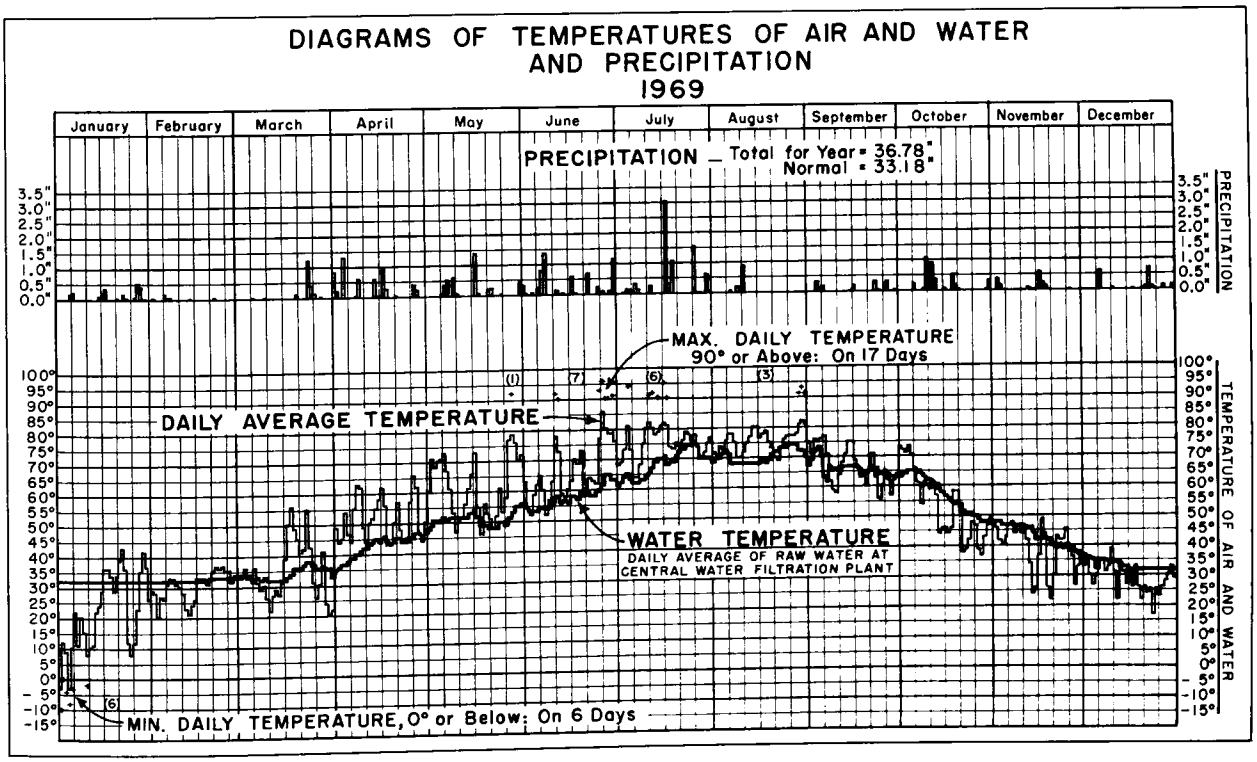
LOCATION	BOILER EQUIPMENT	FUEL BURNING EQUIPMENT	CHIMNEY
SPRING-FIELD AVENUE PUMPING STATION	Four Edgemoor: 665 hp, 4 drum bent tube type, 6650 sq ft surface, 3¼" tubes, 777 sq ft superheater, and water tube rear furnace wall. Steam conditions: 420 psi, 150°F superheat (450 psi Design Pressure) Installed #1-1954; #2, #3 and #4-1953.	Four Westinghouse: 6 retort turbine driven underfeed coal stokers - with hydraulic driven overfeed section and 4 turbine driven forced draft fans.	One 9'9" top dia. 240 ft high Radial brick (1948)
CENTRAL PARK AVENUE PUMPING STATION	Five Edgemoor: 520 hp, 4 drum bent tube type, 5205 sq ft surface, 3¼" tubes, 602 sq ft superheater, and water tube rear furnace wall. Steam conditions: 200 psi, 170°F superheat (400 psi Design Pressure) Installed #1 and #2-1941; #3, #4 and #5-1943.	Five Westinghouse: 5 retort turbine driven underfeed coal stokers - with hydraulic driven overfeed section and 5 turbine driven forced draft fans.	One 10'0" top dia. 242.5 ft high Radial brick (1940)

HEGEWISCH SEWAGE PUMPING STATION - PUMPING EQUIPMENT

Two Laurence Pump and Eng. Co. 20" x 18" Centrifugal pumps, 16 cu ft per second at 10 ft head (installed 1909); driven by two Ford Industrial 4 cylinder, 40 hp gas engines with Falk gear drive (Gear Ratio 9.248 to 1) Input RPM 2050. (Unit No. 1 installed 1968; Unit No. 2 installed 1969)

One Fairbanks-Morse 30" x 24" Centrifugal pump, 35 cu ft per second at 11 ft head; driven by Buda 4 cylinder 6" bore x 7-1/8" stroke, 75 hp gas engine (installed 1933).


ALL WATER PUMPING STATIONS
1969
DIAGRAMS OF TOTAL PUMPAGE AND AVERAGE HEAD
January
February
March
April
May
June
July
August
September
October
November
December
AVERAGE DAILY PUMPAGE = 1,023.49 MGD.
PEAK RATE = 2,180 MGD. on July 16 (8PM.)
MAX. DAY = 1,618.92 MG. - July 16
DAILY PUMPAGE into DISTRIBUTION SYSTEM
PUMPAGE TO RESERVOIR AT WESTERN AVE. PUMPING STATION NOT INCLUDED
(May 29 to Nov. 3, Incl.)
MILLIONS OF GALLONS
HEAD IN FEET


DIAGRAMS OF TEMPERATURES OF AIR AND WATER
AND PRECIPITATION
1969
January
February
March
April
May
June
July
August
September
October
November
December
PRECIPITATION — Total for Year = 36.78"
Normal = 33.18"
MAX. DAILY TEMPERATURE
90° or Above: On 17 Days
DAILY AVERAGE TEMPERATURE
WATER TEMPERATURE
DAILY AVERAGE OF RAW WATER AT
CENTRAL WATER FILTRATION PLANT
MIN. DAILY TEMPERATURE, 0° or Below: On 6 Days
PRECIPITATION
TEMPERATURE OF AIR AND WATER

CITY OF CHICAGO

DEPARTMENT OF WATER AND SEWERS

COMPARATIVE STATISTICS OF PUMPING STATION OPERATION - ELECTRIC AND STEAM

FOR YEARS ENDED DECEMBER 31, 1969 AND 1968

TABLE No.1

OPERATIONAL DATA	69TH STREET		SOUTHWEST		CERMAK		CHICAGO AVENUE		THOMAS JEFFERSON		LAKE VIEW		TOTAL	
ELECTRIC PUMPING STATIONS	1969	1968	1969	1968	1969	1968	1969	1968	1969	1968	1969	1968	1969	1968
ELECTRIC PUMPAGE - MIL GAL	27,142	29,605	31,264	29,095	33,362	29,908	27,936	28,545	20,366	17,352	11,379	13,032	151,449	147,537
AVERAGE HEAD - FT	108.02	111.82	129.45	125.30	104.33	97.79	110.35	105.66	117.25	120.70	113.34	114.90	113.70	111.76
TOTAL RATED CAPACITY - MGD	250	250	175	175	300	300	260	260	160	160	105	105	1,250	1,250
PUMPAGE - MIL FT - GAL	2,931,887	3,310,500	4,047,056	3,645,505	3,480,760	2,924,673	3,082,726	3,015,968	2,387,843	2,094,356	1,289,702	1,497,362	17,219,974	16,488,364
MAX DAILY PUMPAGE - MGD	(8/29) 129.00	(7/16) 137.00	(8/29) 132.20	(7/16) 142.70	(7/16) 172.30	(8/21) 194.00	(7/17) 127.00	(8/22) 138.20	(3/6) 94.10	(8/8) 89.60	(6/18) 60.54	(9/26) 71.09	(7/16) 683.62	(8/22) 719.22
KW HRS CONSUMED	13,928,000	14,354,000	19,905,600	18,355,200	14,435,200	12,643,200	14,800,000	14,640,000	10,107,780	8,884,820	5,248,000	6,016,000	78,424,580	74,893,220
KW HRS CONSUMED PER MIL FT-GAL	4.75	4.34	4.92	5.04	4.15	4.32	4.80	4.85	4.23	4.22	4.07	4.02	4.55	4.54
COST OF ELECTRICITY - OPERATION	$ 148,085.23	$ 151,099.27	$ 204,437.47	$ 190,729.92	$ 159,051.35	$ 139,939.89	$ 157,982.26	$ 152,403.72	$ 111,069.04	$ 98,562.43	$ 66,062.31	$ 67,051.77	$ 846,687.66	$ 799,787.00
COST OF ELECTRICITY - MISC USAGE	$ 652.75	$ 616.13	$ -	$ -	$ -	$ -	$ 554.27	$ 516.35	$ -	$ -	$ -	$ -	$ 1,207.02	$ 1,132.48

OPERATIONAL DATA	MAYFAIR		SPRINGFIELD		CENTRAL PARK		ROSELAND		WESTERN AVENUE			TOTAL	
STEAM PUMPING STATIONS	1969	1968	1969	1968	1969	1968	1969	1968	1969	1968		1969	1968
STEAM PUMPAGE - MIL GAL	H - 29,406 L - 19,482	H - 25,808 L - 21,977	44,021	45,700	48,913	48,911	H - 25,445 L - 21,147	H - 24,340 L - 22,067	A - 33,712 B - 1,925	A - 38,549 B - 3,654		*224,051	*231,006
AVERAGE HEAD - FT	149.67	150.22	128.60	129.81	115.66	122.17	136.23	136.85	111.55	111.73		129.26	130.75
TOTAL RATED CAPACITY - MGD	400	400	360	360	360	360	305	305	320	320		1,745	1,745
PUMPAGE - MIL FT - GAL	7,316,971	7,178,347	5,661,306	5,932,193	5,657,448	5,975,547	6,347,293	6,400,650	3,978,141	4,716,456		28,961,159	30,203,193
PUMPAGE - MAX DAY - MGD	(8/29) 222.60	(7/17) 219.40	(7/16) 188.80	(8/22) 200.10	(7/16) 197.00	(8/21) 211.00	(8/30) 187.00	(7/16) 190.00	(7/16)A-167.90 (7/16)C-186.30	(8/22)A-182.63 (8/21)C-207.20		(7/16)A-935.30 (7/16)C-953.70	(8/23)A-947.78 (8/23)C-972.90
TONS OF COAL CONSUMED	28,966	29,701	22,692	23,326	23,816	23,884	29,048	28,003	7,891	21,769		112,413	126,683
GAL OF OIL CONSUMED	-	-	-	-	-	-	-	-	65,416	-		65,416	-
THERMS OF GAS CONSUMED	-	-	-	-	-	-	-	-	2,180,744	-		2,180,744	-
MIL BTU CONSUMED - OPERATION	679,341	712,055	521,135	561,116	554,920	555,261	690,020	668,422	413,965	508,449		2,859,381	3,005,323
MIL BTU CONSUMED - MISC USAGE	-	-	12,530	13,196	12,823	10,660	4,591	4,324	-	-		29,944	28,180
COST OF FUEL	$ 231,296.89	$ 228,249.53	$ 184,162.53	$ 179,575.31	$ 190,484.18	$ 183,439.45	$ 234,525.45	$ 215,549.23	$ 168,334.89	$ 166,985.67		$ 1,008,803.94	$ 973,799.19
MIL BTU CONSUMED PER MIL FT-GAL	.0928	.0992	.0921	.0946	.0981	.0929	.1087	.1044	.1041	.1078		.0987	.0995
HEAT VAL PER LB OF COAL REC'D BTU AVG	11,955	11,925	11,756	11,756	12,002	11,860	12,021	11,794	11,849	11,930		-	-
HEAT VALUE PER GAL OF OIL	-	-	-	-	-	-	-	-	138,000	-		-	-
HEAT VALUE PER THERM OF GAS	-	-	-	-	-	-	-	-	100,000	-		-	-

*INCLUDES PUMPAGE TO RESERVOIR OF 1,926 MIL GAL IN 1969 AND 3,654 MIL GAL IN 1968 AT WESTERN AVE P.S.

H = HIGH PRESSURE
L = LOW PRESSURE

WESTERN AVE PUMPING STA
A - TO DISTRIBUTION SYSTEM
B - TO RESERVOIR
C - INCLUDES PUMPAGE TO RESERVOIR

AVERAGE DAILY PUMPAGE: ALL STATIONS TO DISTRIBUTION SYSTEM (1969) 1,023.49 MILLION GALLONS
(1968) 1,024.29 " "

MAXIMUM DAILY PUMPAGE: ALL STATIONS TO DISTRIBUTION SYSTEM (7/16/69) 1,618.92 " "
(8/22/68) 1,666.35 " "

TOTAL PUMPAGE FOR ALL STATIONS (INCLUDING RESERVOIR) (1969) 375,500 " "
(1968) 378,543 " "

AVERAGE HEAD IN FEET FOR ALL STATIONS (INCLUDING RESERVOIR) (1969) 122.99 HEAD IN FEET
(1968) 123.35 " " "

TABLE NO. 2

SCHEDULE OF PUMPING COSTS

Year Ended December 31, 1969

Account Number	Object of Expenditures	Steam Stations	Electric Stations	Total
005	Salaries and Wages	$2,466,629	$1,242,986	$3,709,615
025	Vacation Relief	97,936	58,088	156,024
026	Sick Relief	18,418	11,887	30,305
125	Office and Building Services	----	109	109
148	Testing and Inspecting	345	553	898
160	Repairs of Property	60,318	33,529	93,847
162	Repairs of Equipment	452,561	38,395	490,956
166	Subscriptions and Dues	5	----	5
175	Transportation Charges	20	----	20
176	Maintenance & Operation-City Owned Vehicles	----	265	265
182	Heat, Light and Power	155,650	866,670	1,022,320
186	Telephone	5,817	3,517	9,334
270	Local Transportation	----	90	90
312	Coal	903,284	----	903,284
314	Fuel Oil	12,358	----	12,358
318	Fuel for Miscellaneous Uses	146	40	186
320	Gasoline	1,191	----	1,191
340	Material and Supplies	54,649	9,835	64,484
342	Damages, Medical and Chemical Materials and Supplies	17	29	46
345	Apparatus and Instruments	3,104	72	3,176
348	Books and Related Materials	35	----	35
360	Repair Parts	71,699	16,852	88,551
370	Small Tools (Under $10.00)	1,423	119	1,542
375	Tools (Over $10.00)	1,352	323	1,675
801	Centrex Telephone Services	235	1,206	1,441
	Total	$4,307,192	$2,284,565	$6,591,757
Million Gallons Pumped		224,051	151,449	375,500
Pumping Cost per Million Gallons		$ 19.22	$ 15.08	$ 17.55

ARD J. DALEY
MAYOR

DEPARTMENT OF WATER AND SEWERS

BUREAU OF WATER
DIVISION OF WATER PURIFICATION
CENTRAL WATER FILTRATION PLANT
1000 EAST OHIO STREET
CHICAGO, ILLINOIS 60611

JAMES W. JARDINE
COMMISSIONER

RAYMOND D. JOHNSOS
DEPUTY COMMISSIONER FOR WATER

JAMES C. VAUGHN
ENGINEER OF WATER PURIFICATION

OFFICE OF THE COMMISSIONER
DEPARTMENT OF WATER AND SEWERS
CITY OF CHICAGO

August 12, 1970

Dear Alderman:

In line with our policy of keeping the members of the City Council fully informed about our operations we are pleased to furnish you with a copy of our Statistical Supplement to the Annual Report of this Department for 1969.

Respectfully,

Commissioner

JWJ/tp

erned about
an. Our
roughout the
the opera-
resented at
ence in
rt were, in
t of
and 2) an
e can be no
raw water

as cost of
t per million
he lowest
/mil gal
e are the
ids param-

iat from the
ere occurrence
buted to a
itical plant
plant in
demand,

total solids, and bacteria, and at the district's sewage plant in Highland Park, only 30% of the same substances are removed. This results in the discharge to the lake of significant amounts of inadequately treated sewage to the lake. This resulted in some abnormally high bacterial counts in the untreated water at the intake of the Central Water Filtration Plant (CWFP). For example, on March 25, 1969, the confirmed coliform bacterial count of raw water at this plant reached 970/100 ml; on April 19, 1969, this value was 1,300/100 ml; on July 27,

445 Form W.&S.W. 43 5M

the value was 910/100 ml; on August 24, the value was 4,400/100 ml; on September 3, the value was 916/100 ml. Comparing these values with the 1968 average, which was 120/100 ml, it is obvious that these unduly high values are attributable to unusual and unnecessary pollution by the inadequately treated sewage.

During the year we began to have an increasing number of complaints of the quality of the water in various large buildings around the city. In December, a complaint of a "sour taste" in the water at a loop department store was investigated by Water Quality Section engineers. The discovery of Ethylene Clycol "Anti-Freeze" in the drinking water, which was introduced when 4,000 gallons of Ethylene Glycol was pumped into the building's air conditioning system, required the services of a city plumbing inspector to trace and break the cross connection to the domestic water supply. The Chicago Chemistry Laboratory had to analyze and identify the contaminant. The water quality engineers were required to supervise and coordinate operations and thoroughly flush and sample the building's drinking water supply before making it available to the public. Our Water Quality Surveillance Section (WQSS) and the Plumbing Inspection Section have done excellent jobs in correcting these situations which are largely due to bad plumbing.

The Water Purification Laboratory has continued to improve its techniques through instrumentation that is now available for service. It has the Gas Chromatograph which separates fractions of organic contaminants which have been extracted from the water by means of carbon filters. These separated fractions are identified by putting them through the Infra-red Spectrometer which gives us a chemical fingerprint of the material which may lead to definite identification of the sources of the organic contaminants. An Atomic Absorption Unit provides rapid and accurate determinations of the metallic elements. The Microbiology (Bacteriology) Laboratory was approved by the Illinois State Board of Health as the first to be approved by the State for the bacteriological analysis of water. Its Certificate of Approval is Number 1. This is a matter of great pride and credit to the Bureau of Water.

With the exceptions noted above, the Central Plant enjoyed an unusually good year in its operation. Pumpage was not excessive; the incidents of alewife fish were not excessive; and there were no major interferences with general operation. Two improvements were made: they were the use of caustic soda in adjusting the final pH of the water, and the installation of auxiliary mixing in chemical application channel #5. A number of small improvements were made in the operating system. The most important of which was the installation of fusible interrupt switches on each of the eight low lift pumps. With these additions, individual pumps can be taken out of service for maintenance without having to interrupt the power supply to half the plant

I. Administration

The Administrative Section continues to function smoothly. All personnel constantly utilize their available information in the performance of their duties. In addition to payroll and personnel data, all account expenditures and balances are current and available at the time of inquiry. The section coordinates fixed asset and material and supplies inventories for the Division. Statistical and inventory reports are issued monthly and all procurement is coordinated and initiated from this section, thereby freeing technical personnel for operational duties. In the Division Summary Sheet of Total Expenditures and Performances which follows report of this section, it is observed that salary expenditures are up and contractual expenditures are down. Commodities are up as are equipment and operating expenses. As a result, the total cost per million gallons of water pumped for the Division is up slightly at the South Plant and appreciably at the Central Plant. It must be noted here that this summary applies to expenses incurred and not to actual materials used.

II. Central Water Filtration Plant (CWFP)

1. Probably the most important of the improvements made at CWFP during 1969 was the installation of 4,160 volt disconnect switches on each of the eight low lift pumps. This enables us to perform electrical work on any of the low lift pumps by simply disconnecting it instead of killing the power to four pumps as was necessary previously.

2. A complete system for feeding caustic soda for more accurate pH control was installed this year. The caustic soda treatment to our filtered water supplements the hydrated lime treatment and permits very close control over the pH of water going to the distribution system.

3. Studies are almost completed on settling basin sediment removal in connection with the program to discontinue discharging the sediment to Lake Michigan.

4. Work is nearing completion on the connection of the raw water supply tunnel to the existing Chicago Avenue Tunnel. When completed, the tunnel will furnish part of the raw water supply to CWFP from Dever Crib.

5. The installation of log-pile monitors in all 16 settling basins continued and is now complete. These units are used to more efficiently perform the task of cleaning sediment from the unscraped portions of the settling basins annually.

II. Central Water Filtration Plant (continued)

6. The chlorine room emergency supply and exhaust air system was revamped to provide a negative pressure inside the chlorine area, thus permitting a faster, more positive system for removal of any chlorine gas emanating from leaks in the system.

7. Studies were started to determine means of improving flocculation at CWFP. A 25-horsepower mixer was installed experimentally in one chemical application channel to observe the effects of "flash-mixing" upon coagulation. Work will continue on this project as personnel become available.

III South Water Filtration Plant (SWFP)

The year 1969 has been one of the accelerated extra effort years in the history of the SWFP in terms of Improvements and Accomplishments. A most noteworthy performance was put forth by senior technical engineers in design concepts and reports for future Control Room Instrument Panel and Chemical Storage and Feed Equipment revisions. The year has been one of increased security awareness by all echelons of plant personnel. Safety Consciousness has been emphasized by adminstrative personnel and the plant safety engineer. Safety meetings were held on a regular basis during the year. More discriminate feeding of treatment chemicals took place during the entire year with an eye toward avoiding waste and keeping purification costs as low as possible commensurate with highest quality outlet water supply.

The more tangible accomplishments and improvements during the year are as follows:

1. The 73rd and 79th Streets outlet land tunnels were successfully taken out of service and their respective flow meters calibrated. In this endeavor we had the full cooperation of other units in the Bureau of Water.

2 A new structure was erected for housing the new Control Room and the F.E V office. Remodeling of original Chemical Control Laboratory and old Control Room into new Chemistry Laboratory was accomplished

3 A high pressure water system (pump, piping, and controls) was installed for cleaning intake basin screens and an access cut into intake basins from -24 level area of the low lift pumping station for this system and other future uses.

4 Access stairways were installed in Basins 1 and 3 at Cols. 18-1/2 and 35 It is planned to install stairways in Basin 2 this spring.

III. South Water Filtration Plant (continued)

5. Flow meters were installed in the metering channels of Basins 1 and 3. It is planned to install a flow meter in the metering channel of Basin 2 this spring.

6. Low lift pump No. 1 was overhauled. New bearings, wear rings and casing rings were installed.

7. Four 16" butterfly valves, to serve as header valves on the surface wash water system of galleries 1 through 4 inclusive, were installed.

8. Adapted lime unloading facilities for truck deliveries in order to expedite lime receipts and lessen storage requirements was accomplished.

IV. Water Purification Laboratory

1. Thus far, 1969 has shown continued expansion and improvement in analytical services provided by all three units of the Water Purification Laboratory. The Chemistry Unit now provides regular operation using the Atomic Absorption Instrument for precise and rapid determination of rather minute quantities of metallic ions present in water. Its usefulness is especially significant in the area of detection of toxic metals, such as lead, chromium and cadmium which may enter the water supply through pollutionary sources. The Gas Chromatograph is presently being operated and prepared for use especially in pesticide work. Final parts on order are scheduled to be delivered within the next few weeks. This instrument is used for the detection of small quantities of organic contaminants found in lake water resulting from pollution of Lake Michigan. This equipment can separate into obtainable fractions extremely small quantities of organic contaminants such as hydrocarbons and pesticides. It is also used for separation of samples for further analysis by our Infra-red Spectrophotometer. The Infra-red Spectrophotometer is fully operative. It is presently being used in conjunction with the carbon chloroform extraction procedure for organic substances in water. It will also be available for use with the Gas Chromatograph on pesticide analyses. This instrument is another large complex and rather delicate instrument for determining specific organic chemical materials. Many of the organic industrial pollutants can be identified using this equipment.

2. We also have a new Coleman Spectrophotometer for analyses using absorbance and transmittance techniques. The use of this instrument expands our capabilities in the analytical area formerly carried solely with the Beckman DU Spectrophotometer

IV. Water Purification Laboratory (continued)

3. We presently have a Technicon instrument transferred from CWFP which is in operation and serving well for the determination of ammonia nitrogen content of water. In Microbiology, photographic equipment has been installed on our Bausch and Lomb microscope, making photomicrography available to us for bacteriological plankton studies.

4. A Permanent Objective Aperture has been installed in our electron microscope which will improve stability and which reduces the down time for aperture cleaning which previously was necessary. This should save a considerable number of man-hours per month in electron microscopy down time.

5. Micology studies have been instituted primarily in the Electron Microscopy Laboratory but with some cooperative work being done in the Microbiology Section. This work is aimed at isolating and identifying fungal organisms which are believed to produce taste and odors in our water supply.

6. Continued additional improvements in all regular areas of our analytical work are evident but the above we believe are significant accomplishments achieved in 1969.

7. The John R Baylis Memorial Library is performing its planned functions to a limited degree. The bronze plaque bearing a bas-relief of Mr. Baylis has been received and mounted. The final collection of Journals is being bound and should be returned shortly. The Library of Congress cards for the books on hand have been ordered and should be received presently. It is hoped to be able to pronounce the Library available for dedication sometime during 1970.

V. Water Quality Surveillance Section

1. The Water Quality Surveillance Section performed main sterilizations, sample collections, complaint and emergency investigations, river surveys and other routine duties during the year 1969. Along with this, a program of lake surveys was attempted and the surveys performed were the North Shore Lake Survey, the South Shore Lake Survey, the Central Water Filtration Plant Radial Survey, and the South Water Filtration Plant Radial Survey. The small boat harbors were sampled again this spring and summer. Two land surveys of nearby Lake Michigan waterworks intakes were also performed.

V. Water Quality Surveillance Section (continued)

2. The completed new tunnel connections, for removal of the steel wet well at Springfield Avenue Pumping Station, were inspected and sterilized. The old chlorination shafts at Central Park, Cermak, Chicago Avenue, Thomas Jefferson, and Mayfair Pumping Stations were inspected and sanitation maintained during and after the removal of iron work and chlorination facilities. This entailed working with the City diver on a number of occasions.

3. The Mayfair pressure tunnel was inspected, sterilized and approved for service and new sections of the discharge header at Mayfair Pumping Station were sterilized and approved for service. The recirculating line installed at the 68th Street Pumping Station was also sterilized and approved for service

4. Plans were reviewed for the construction of suburban waterworks facilities or additions for Burnham, Hillside-Berkeley, Hickory Hills, Hodgkins, Maywood and Schiller Park. Thirty-four of the suburban water facilities were inspected during the first eight months of 1969. Plans were also reviewed for the McCormick Place fire and domestic water systems.

5. A chlorine residual recorder was installed at Western Avenue Pumping Station to monitor the water leaving the reservoir.

6. A new sampling device fabricated out of Polyvinyl Chloride was used in the sampling of water mains. This can or will replace the goose-neck sampler which is made of galvanized or brass pipe fittings. The latter is adequate but is subject to corrosion.

7. The vessel watering points were inspected and reviewed in the Chicago and Calumet areas.

8. Specifications were written for proper procedure in supplying consumers with temporary water supply hose connections if permanent services have to be cut during the construction of large sewers such as the one in South Washtenaw Avenue.

9. Also, new copper snow cans for the measuring of snowfall were ordered from the Sheet Metal Shop for replacement of those presently in service which need replacing.

TABLE I

ODORS, AMMONIA NITROGEN (NH_3-N) AND CARBON DOSES
South Water Filtration Plant
1965, 1966, 1967, 1968, 1969

Year	Average daily carbon dose (lb/mil gal)	Maximum daily average carbon dose (lb/mil gal)	Average [1] ammonia nitrogen	Maximum ammonia nitrogen
1965	23	230	0.017	0.111
1966	33	328	0.028	0.126
1967	32	400	0.030	0.376
1968	33	411	0.019	0.250
1969	18	400	0.020	0.250

[1] Raw Water Header

TABLE II

ODORS, AMMONIA NITROGEN (NH_3-N) AND CARBON DOSES
Central Water Filtration Plant
1965, 1966, 1967, 1968, 1969

Year	Average daily carbon dose (lb/mil gal)	Maximum daily average carbon dose (lb/mil gal)	Average ammonia nitrogen	Maximum ammonia nitrogen
1965	23	36	0.014	0.101
1966	20	24	0.017	0.132
1967	18	110	0.020	0.150
1968	13	100	0.010	0.100
1969	11	61	0.010	0.160

TABLE III

ODORS, AMMONIA NITROGEN (NH_3-N) AND CARBON DOSES
South Water Filtration Plant
1962-1969

Year	No. of days of over 30,000 lb carbon use	Average daily carbon dose (lb/mil gal)	Maximum daily average carbon dose (lb/mil gal)	Average [1] ammonia nitrogen	Maximum ammonia nitrogen
1962	6	21	192	0.010	0.102
1963	12	23	252	0.023	0.140
1964	19	27	361	0.026	0.203
1965	7	23	230	0.017	0.111
1966	30	33	328	0.028	0.126
1967	34	32	400	0.030	0.376
1968	40	33	411	0.019	0.250
1969	10	18	400	0.020	0.250

[1] Raw Water Header

TABLE IV

CONTRACT PRICES PER TON
Central and South Filtration Plants
1965-1969

	Chemical		
Year	Alum Liquid	Carbon	Chlorine
1965	$39.95	$156.70	$83.20
1966	40.55	156.70	95.20
1967	41.85	166.60	97.20
1968	43.45	178.00 *	89.40
1969	43.75 **	173.00 **	95.40 **

* Regular air slide hopper car
** Average

TOTAL CHEMICAL COSTS
Water Purification Division
1965-1969

Year	Pumpage/mil gal	Total $	$/mil gal
1965	370,582	1,689,201	4.44
1966	391,682	2,394,888	6.12
1967	393,656	2,466,374	6.27
1968	388,125	2,299,421	5.92
1969	385,775	2,177,808	5.65

HYDROFLUOSILICIC ACID
AVERAGE PRICE

1968	1969
$34.24/ton	$51.09/ton

49% increase

WATER PURIFICATION DIVISION
SUMMARY OF TOTAL EXPENDITURES AND PERFORMANCES
1969

DIVISION ACTIVITIES	NUMBER OF EMPLOYEES ON PAYROLL	.000 PERSONNEL SERVICES (SALARIES)	.100 CONTRACTUAL SERVICES	.200 TRAVEL	.300 COMMODITIES	.400 EQUIPMENT	.800 SPECIFIC SERVICES	OPERATING AND CAPITAL EXPENDITURES	* PERFORMANCE			
									M G TREATED	TEST MADE	INSPECTION MADE	COST PER UNIT $
ADMINISTRATION ACTIVITY 8241	35	196727	9649	2412	2457	8967		220212				
SOUTH WATER PLANT ACTIVITY 8242	168	1834989	371511		917435	30039	41056	3195030	141779			22.32
WATER PURIFICATION LABORATORY ACTIVITY 8243	48	383091	5857		41499	1035		431482		232512		1.85
WATER SAFETY CONTROL SECTION ACTIVITY 8244	20	206231	4804		5844	6388		223267				
MAKING DREDGING & MISC. INSPECTIONS ACTIVITY 8245	10	80827						80827			21101	3.83
CENTRAL WATER PLANT ACTIVITY 8248	244	2524041	672074		1627761	32235	76584	4932695	243996			20.08
DIVISION TOTALS ACTIVITY 8240	525	5225906	1063895	2412	2594996	78664	117640	9083513				
TOTAL MG TREATED									385775			23.34
TOTAL TESTS										232512		
TOTAL INSPECTIONS											21101	

* PERFORMANCES ARE FIGURED ON OPERATING EXPENDITURES ONLY

CENTRAL WAIER FILTRATION PLANT

Timothy D. Nulty
Chief Filtration Engineer

The Central Water Filtration Plant supplied a total of 235 billion gallons of pure, filtered water to approximately 3 million people in the North and Central Water Districts of Chicago and 38 bordering suburban areas during 1969. Continuous improvement and maintenance of pumping, chemical feeding and monitoring equipment prevailed in supplying the best water possible.

A total of 15,983 people visited the Central Water Filtration Plant during the year, of which, 100 came from 17 foreign countries. July and August were popular months for visitation when 5,064 people went through the plant. Regularly conducted tours were open to the public from 1:00 p.m. to 5:00 p.m. on Tuesdays, Thursdays, Saturdays and Sundays during June, July and August and on Saturdays and Sundays during the remainder of the year.

LOW LIFT PUMPAGE

The Central Water Filtration Plant pumped a total of 243,996 million gallons (mil gal) of raw water from Lake Michigan during 1969 for a daily average of 668 million gallons per day (mgd). This was only 0.85% more than was pumped the previous year. Approximately 9,000 mil gal or 3.69% of the water pumped from the lake was used in operation of the plant for desedimentation, backwashing of filters, service water, process water, etc.

LOW LIFT PUMPAGE 1965-1969

YEAR	TOTAL mil gal	AVG mgd
1965	233,687	640
1966	249,598	684
1967	252,549	692
1968	241,939	661
1969	243,996	668

A new record maximum hourly pumpage rate of 1,494 mgd was reached between 3:00 p.m. and 4:00 p.m. on July 16, 1969. The previous high rate was 1,473 mgd pumped between 3:00 p.m. and 4:00 p.m. on August 22, 1968. The maximum daily pumpage of 1,057 mil gal on July 16, 1969 was the second highest day in the plant's history, exceeded only by the record of 1,107 mil gal on August 21, 1968.

SUMMARY OF PEAK LOW LIFT PUMPAGES

YEAR	MONTH mil gal		DAY mil gal		HOURLY RATE mgd	
1965	23,091	(July)	947	(7/23)	1,180	(7/23 @ 3:00 p.m.)
1966	28,650	(July)	1,045	(7/26)	1,309	(7/26 @ 2:00 p.m.)
1967	25,346	(Aug.)	996	(6/15)	1,443	(7/21 @ 4:00 p.m.)
1968	27,452	(Aug.)	1,107	(8/21)	1,473	(8/22 @ 4:00 p.m.)
1969	26,215	(Aug.)	1,057	(7/16)	1,494	(7/16 @ 4:00 p.m.)

Although the month of July was the second wettest July on record, the peak hourly pumpage rate and the peak pumpage day (July 16) climaxed a dry period of six days in which the air temperature reached and/or exceeded 90° on 4 days. (All temperatures referred to are in Fahrenheit degrees). The average air temperature on July 16 was 85° with a high of 95°. The following day (July 17) 3.04 inches of rain fell and the average air temperature was 81° with a high of 90°. Total precipitation in July was 7.58 inches, 4.21 inches over normal. The average air temperature for the month was 74.9°, 0.7° below normal and there were only six days on which the temperature rose to 90° or more.

The month of August was considered one of the hottest Augusts on record which was reflected by the total monthly pumpage, the maximum for the year. The average air temperature of 75.3° was 1.1° above the normal of 74.2°. There were only three days in which the temperature rose to 90° or more (the last 3 days of the month). There was a total of 25 days in which the maximum temperature were in the 80's. The lowest daily maximum was 77°. The rainfall in August was 2.05 inches below normal.

During the summer months of 1969, the temperature rose to 90° or more on 17 days, nine days less than expected in an average year.

CHEMICAL TREATMENT AND FEEDING EQUIPMENT

The average chemical cost for water treatment during 1969 increased to $5.71 per mil gal from $5.22 per mil gal in 1968. There was very little change in the amount of chemicals per mil gal applied to the water,

however, the use of caustic soda as a supplement to lime for better pH control did add to the total cost as did the very significant increase in the price of fluorine.

CHEMICAL COSTS

	1968			1969		
	lbs/mil gal	$/Ton	$/mil gal	lbs/mil gal	$/Ton	$/mil gal
CHLORINE	19.1	95.80/T	0.88	20.5	95.90/T	0.97
ALUM	102	42.78/T	1.58	100	43.80/T	1.54
IRON	94	27.48/T	0.34	101	25.54/T	0.39
LIME	41	29.79/T	0.61	34	30.57/T	0.53
CAUSTIC SODA		55.12/T	0.01	12	53.48/T	0.28
CARBON	13	160.38/T	1.04	11	169.80/T	0.96
FLUORINE	6.8	201.80/T	0.76	6.8	318.40/T	1.04
TOTAL			5.22			5.71

The Central Water Filtration Plant received 2,080 deliveries of water treatment chemicals during the year of which 1,982 were made by truck and 98 by rail. The number of truck shipments increased due largely to an increase in truck deliveries of hydrofluosilicic acid and all deliveries of caustic soda were made by truck. Forty-seven out of forty-eight deliveries of carbon were made in "Jumbo" (30 ton capacity) railroad cars. The one truck load of carbon received was a trial shipment from a new supplier. The use of the "Jumbo" railroad cars represents a saving of $6.62 per ton of carbon or a total of approximately $9,000.00 for the year. (Fluoride application was resumed on January 24). Hydrofluosilicic Acid had been in short supply from the previous year.

The split treatment of water by the application of alum and ferrous sulfate as coagulants was practiced throughout the year except for short periods when alum was more effective or when ferrous sulfate was in short supply. Ferrous sulfate feeding was discontinued on July 28 and resumed on September 4 when stock was replenished. A period of short supply was again experienced from November 10 to December 15.

The last two, of four, mixing units on lime storage and feed tanks were replaced by the original supplier to meet specifications. The second, new, lime transfer pump was installed in a program started last year to provide more reliable movement of lime from receiving to storage.

Reworked impellers and new 20 h.p. motors were installed on ferrous sulfate feeding pumps to insure proper deliveries of the chemical during high consumption periods.

CHEMICAL CONTROL LABORATORY

The chemical control laboratory performed more than one quarter million tests during the year of which 89% (215,325) were routine control determinations made on a 24 hour daily work schedule. The results of these tests were used by the control center engineers for determining the best chemical treatment for the water and verification of results shown on trend recorders measuring residual chlorine, pH and turbidity. The remaining 11% of the tests performed (26,265) were analyses requiring more time to complete such as (1) those run on water treatment chemicals to check for compliance with specification requirements, (2) special determinations requested by Filtration Engineers and (3) regular analyses for fluoride, odor threshold, ammonia-nitrogen, temperature, alkalinity, hardness and free carbon dioxide performed much less frequently than those for routine control.

RAW AND TREATED WATER QUALITY

As in previous years, the plant continued to produce a pure, clear, palatable water from a raw water whose physical, chemical and bacteriological qualities changed from natural and environmental causes.

Turbidity

The average raw water turbidity for the year was 9 Jackson Turbidity Units (JTU) as compared to 8 JTU in 1968. The highest monthly average was 29 JTU in April which had a maximum daily average of 65 JTU and a minimum daily average of 9 JTU. The maximum single determination was 94 JTU on April 24 as compared with a maximum of 120 JTU on January 27, 1968.

Plankton

Stephanodiscus Hantzschii was the most prominent plankton organism present in the raw water from January 1 through June 30. Tabellaria was the most prominent in July and August although Dinobyron was prominent for 12 days in July. Fragilaria took the lead in September, October, November and December as the prevalent organism.

The highest monthly average plankton count was 4,000 per milliliter (ml) in April and the lowest monthly average was 430 per ml in August. The highest count in one day, 10,500 per ml, occurred on March 9. The lowest daily count of 80 per ml was indicated on August 4.

Odors

Odors were a minor problem in 1969. A hydro-carbon odor appeared in the raw water on 4 days in January. The maximum threshold detected was 6 Ch on January 24. On April 21, complaints were received from the public of odors in tap water described as musty. Although no unusual, detectable, raw water odor was noted at the plant, the carbon dosage was increased from a nominal 10 lbs per mil gal to 50 lbs per mil gal. The average daily carbon feed ranged from 18 lbs per mil gal to 44 lbs per mil gal between April 21 and April 27. The odor complaints were substantiated by odor tests run on samples collected by the Water Quality Surveillance Section. Further investigation indicated that a musty odor was developed in the distribution system after treatment.

Calcium Carbonate Stability

The addition of caustic soda to the finished water greatly improved the control of the pH (hydrogen ion concentration) of the finished water. The pH of the water now leaving the plant can be adjusted to maintain a saturation index that will prevent corrosion in the distribution system. The raw water pH ranged from 7.92 to 8.99 in 1969 averaging 8.40 for the year. The addition of certain water treatment chemicals lowers the pH and almost always requires the addition of lime and/or caustic soda to adjust the pH to a proper value. The average outlet water pH achieved in 1969 was 8.23 as compared with 7.91 in 1968.

The table below shows the improvement in the finished water quality.

SUMMARY OF WATER QUALITY

	RAW WATER						OUTLET WATER	
	AVG		MAX		MIN		AVG	
	1968	1969	1968	1969	1968	1969	1968	1969
TURBIDITY (JTU)	8	9	120	94	1	1	0.2	0.1
ODOR THRESHOLD	2M	2M	9Ch	6Ch	1M	1M	2Cc	2Cc
pH	8.26	8.40	8.70	8.99	7.82	7.92	7.91	8.23
NH_3N ppm	0.01	0.01	0.10	0.16	0.00	0.00	----	----
TEMP. °F	49°	49°	72°	76°	32°	32°	----	----
FLUORIDE	0.10	0.15	0.28	0.46	0.0	0.0	0.98	0.99
FREE CHLORINE RESIDUAL (ppm)	-----	-----	----	----	----	----	0.73	0.73
PLANKTON (per ml)	2,800	2,000	14,000	11,000	130	80	4.3	2.0
COLIFORM BACTERIA Per 100 ml	120	100	16,000	4,000	0	0.0	0.0	0.0

RAW WATER SUPPLY

The off shore water supply was used exclusively in 1969 since the expected use of the Dever Crib supply did not materialize. The work on the crib tunnel connection, which was to be completed this year, met with a few, but long delays. However, difficulties were overcome and the use of the Dever Crib supply is expected early in 1970.

ALEWIFE FISH AND ALGAE

An uninterrupted supply of raw water was maintained throughout the year. Ice formations at the intake gates in the winter and fish and weed concentrations the remainder of the year are constant threats to maintaining an ample supply to the plant. With the labeled phrases, "ice watch" and "traveling screen watch", a close surveillance was kept over the incoming water throughout the year. The "ice watch" is maintained from the onset of winter and the removal of the screens to the time in spring when screens are reinstalled. The "screen watch" is kept from the time screens are installed to the time of removal.

The alewife barrier net was installed on April 11 and 12. The triangular enclosure around the intake ports reduced the amount of fish getting to the traveling screens. Sonar runs were made periodically with the plant boat "Cee Wee" to determine the concentrations of alewife in the waters surrounding the plant. Only one run, made on May 19, revealed heavy concentrations of fish around the plant, but only light amounts inside the net enclosure.

The installation of the screens was completed on April 3 and the screen watch was maintained from April 11 to December 4. In this period of 238 days the fish concentrations were designated as none on 130 days, light - 91 days, light to medium - 4 days, medium - 1 day, light to heavy - 5 days, medium to heavy - 5 days, heavy - 2 days. In the same period, the weed concentrations were summarized as being none on 145 days, light on - 75 days, light to medium - 3 days, medium - 7 days, light to heavy - 4 days, medium to heavy - 1 day, heavy - 3 days. Frequent inspections and maintenance of the traveling screens kept all eight screens in full operation during the entire season.

The winter of 1968-69 marshalled in the first anchor ice on December 24, 1968. January, 1969 saw five periods of ice over 12 days for a total of 203 hours. The winter season ended with the appearance of ice in 2 periods on 4 days in February for only a total of 28 hours. The 1969-70 winter season ushered in ice on the 21st of December, ending the year with 5 periods in 5 days totalling 54 hours.

The formation of anchor ice occurred on 21 days in 12 periods for a total of 285 hours. The longest period was 85 hours from 7 p.m. on January 7 to 8 a.m. on January 11. To alleviate the icing condition, a total of 2,781,750 lbs of steam was used at an average of 9,750 lbs per hour. In 1968, a total of 3,295,500 lbs of steam was used in 326 hours, for an average of 10,109 lbs per hour.

1969

SUMMARY OF ANCHOR ICE PERIODS AND STEAM USED

Month	No. of Periods	No. of Days	Total Hours	Pounds of Steam Used
JANUARY	5	12	203	1,887,500
FEBRUARY	2	4	28	305,500
DECEMBER	5	5	54	588,750
TOTAL	12	21	285	2,781,750

SETTLING BASIN OPERATION

All settling basins were dewatered and cleaned during the year. The basins in the west half were cleaned in the Spring and those on the east half were cleaned in the Fall. Spring cleaning began on February 25 and was not completed until June 27. Fall cleaning began on September 30 and was completed on December 13.

The cleaning periods, both in Spring and Fall appear to have taken considerable time, however, log pile monitors were installed in 11 of the 16 basins, leaving 1 basin yet to be supplied with monitors.

Ten of the 16 basins were out of service twice during the year. Some of the log pile monitor work was done after basin cleaning. Flash mixer installation, repair work to the floor in #7 Application Channel, cross collector maintenance and inspection resulted in additional down time of some of the basins for varying periods.

FILTER OPERATIONS

The nature of the raw water quality, and the subsequent chemical treatment plus effective settling in the basins reflected in long filter runs through the year. The average filter run for the year was 47.9 hours; 22.2% longer than the average run of 39.2 hours in 1968. April, with the highest monthly average run of 58.3 hours, was notable because it was the month with the highest average raw water turbidity of 29 JTU and highest average plankton count of 4,000 per ml. Alum was used as a coagulant through the whole month of April except for 3 days when ferrous sulfate was used on half the water treated.

Ferrous sulfate was used in 30% of the raw water treated in 1969 and alum was used in 70% of the raw water. This practically reflects the same proportion of treatment as in 1968 when 27% was treated by ferrous sulfate, and 73% was treated by alum.

There were 17,184 filter washes in 1969 requiring a total of 5,026 mil gal of filtered water which amounted to 2.1% of the total water pumped; this is a slight deduction from the 2.6% wash water ratio in 1967 and 1968. The maximum number of filters washed in one day was 132 on both January 31 and July 16; considerably less than the maximum number of 252 on October 31, 1968.

The annual check on sand and gravel elevations made during the summer months by student Engineers in Training did not show any appreciable variation over the past several years.

The rate of flow control of all 96 filters has been extended to one focal point in the control center. It is now possible to set the filtration rate manually at a fixed rate for all the filters or place the entire plant on automatic control with the rate of flow being controlled by the level in the south reservoir.

COMPUTER DATA LOGGER

The computer Data Logger has operated successfully through 1969 with a moderate number of shutdowns for m[illegible] repairs. No major shutdowns were experienced during the year.

The control center engineers have gradually used more computer data in the routine operation of the plant. Computer programs are successfully operating to proportion some chemical feeds to the water flows calculated by the computer.

The telemetry of pumpage flow signals from the seven pumping stations is operable, but some adjustments are required for more accurate readouts. An additional thirty-two telemetry points to indicate distribution system pressures are being added. This should be operable by mid-February 1970.

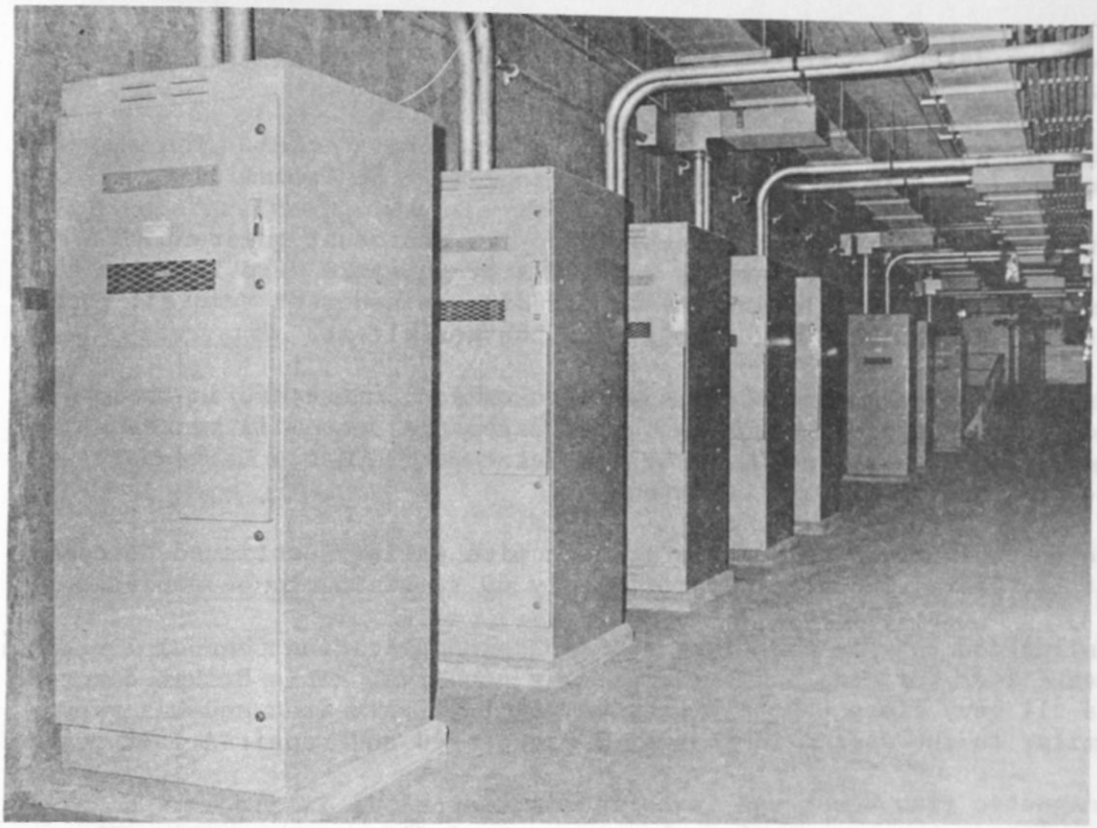
The computer also has proven to be of great value in off-line listing and calculation of the annual inventories for both filtration plants and both laboratory facilities.

A continuing program of IBM training has been undertaken to enable Control Center Engineers to avail themselves of the computer. This should enhance its use in succeeding years.

GENERAL

Listed below are some of the major activities that transpired in programs of maintenance and improvements in mechanical and structural facilities.

Fusible interrupt switches were installed on all eight low lift pumps. With these additions, individual pumps can be taken out of service for maintenance without having to interrupt the 4,160 volt power supply to half the plant.



4160 Volt Fusible Interrupt Switches

The 1,200 psi low lift pump hydraulic system revision is progressing and when finished will provide individual accumulators for each of the low lift pumps.

An experimental mixer was installed in Chemical Application Channel 5 attempting to provide flash mixing of chemicals and secure better coagulation and settling in basins. Indications are that there is some improvement. Two identical mixers will be installed in 2 channels next year. This will provide one entire quadrant to compare coagulation and sedimentation against any of the other three.

Glass ball valves were installed in part of the supply lines immediately behind the chlorinators replacing the original valves which were causing considerable trouble by freezing in one position.

Tests were made on the use of hot water in place of steam to supply heat for the chlorine evaporators for emergency purposes. The tests were run for 8 hour periods and proved successful. This will afford a back up to the emergency steam generator.

The chlorine emergency alarm system was revised, calling for dehumidification equipment to be shut off when alarm is sounded. This was done to prevent any chlorine fumes which may escape from the confines of the chlorine area, due to a leak, from being spread to other areas of the plant.

The fire detection system for remote storage areas was completed this year.

Two Caustic Soda storage and feeding tanks were erected. The mechanical equipment (mixers, pumps and piping) will be installed in 1970.

A magnetic flow meter was installed in the southeast quadrant 10" sediment line and two ferrous sulfate storage tanks were isolated and connected to the sediment line for studies in sediment removal. Some data was accumulated and supplied to the consultant.

Carbon column absorption units were installed, one each, in the raw and treated water sample lines. The carbon columns will be changed every two weeks for analysis by the Water Purification Laboratory for the presence of organic compounds.

The reconstruction of corbels in main pipe gallery continued throughout the year. There are approximately 60 remaining to be replaced.

Spalled concrete in the floor of Chemical Application Channel 7 between east filter building and headhouse was repaired. This broken concrete was all very close to the expansion joint in this area and was very similar to the damage in Channel 5 discovered and repaired last year.

A magnetic flow meter was installed in Channel 11 in place of original propeller meter to test for the accuracy of flow measurement. The flow signals obtained from the flowmeters in the Chemical Application Channels is used to automatically control chemical feeds.

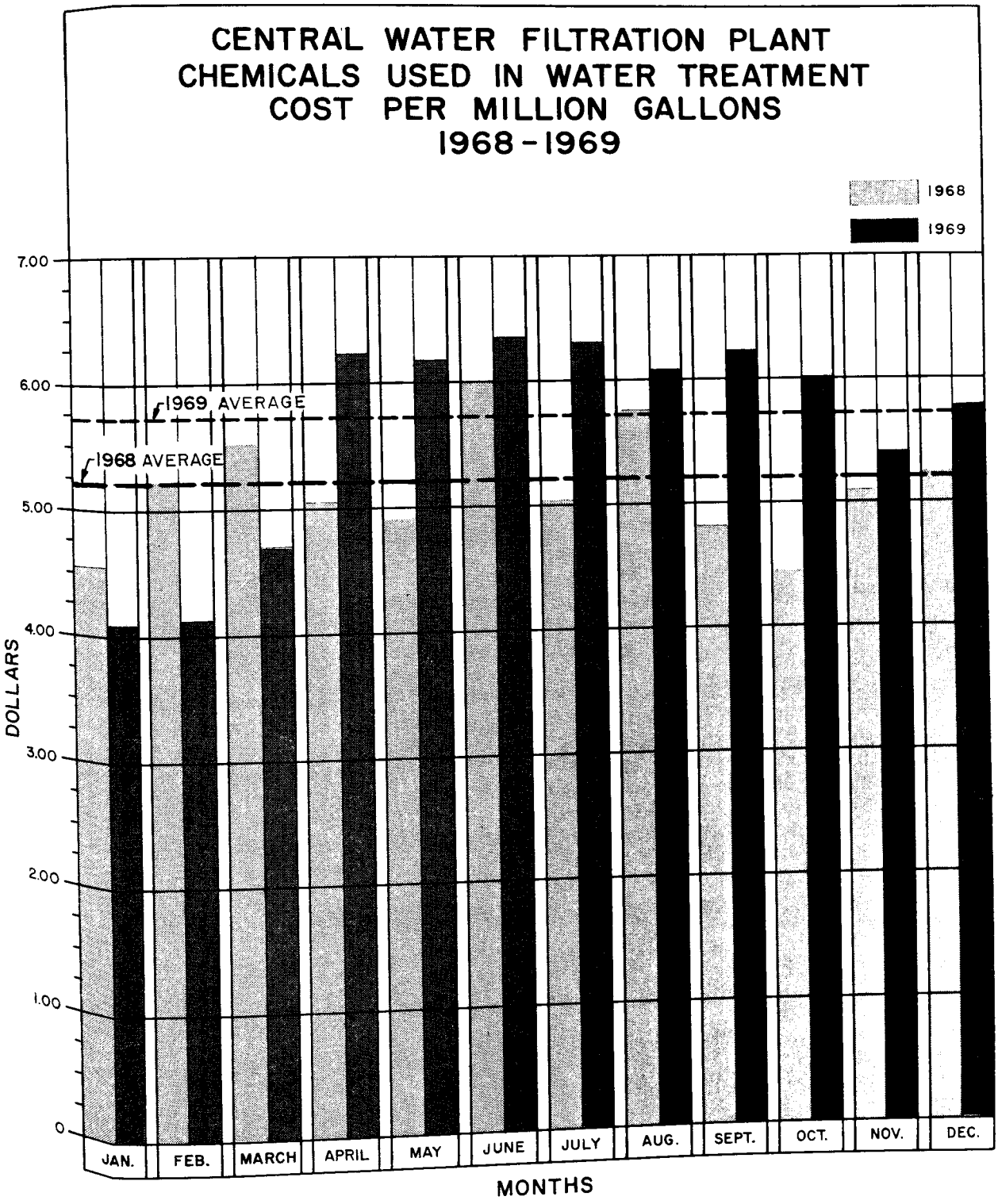
The North Filtered Water Collector flow meter was repaired and reinstalled. It had been damaged the previous year by a straightening vane, which is nothing more than a steel plate, and was found broken loose during an inspection of the north filtered water collector.

The east wall of settling basin 13 was found to be leaking into the void space between the west filter building and the head house. The wall of the settling basin appears to have been damaged by a crushing action caused by the movement of structures. The basin is out of service while preparations are being made to repair the failure of the damaged section of the concrete wall.

PROGRESS AND PLANS FOR PRESENT AND FUTURE WORK

Chlorine feed system

Monel ball valves in chlorine manifolds are being replaced with glass ball valves. The plan for the conversion of 2 chlorinators and the addition of a third chlorine line to supply ample pre-chlorination is in progress. The plan for the replacement of outlet chlorine lines is being implemented and material is being ordered.


CENTRAL WATER FILTRATION PLANT
CHEMICALS USED IN WATER TREATMENT
COST PER MILLION GALLONS
1968 - 1969
1968
1969
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0
DOLLARS
1969 AVERAGE
1968 AVERAGE
JAN.
FEB.
MARCH
APRIL
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
MONTHS

SOUTH WATER FILTRATION PLANT

Morris Kaplan
Chief Sanitary Engineer

The South Water Filtration Plant completed its 24th full year of operation in 1969. This entire period of operation has been on a manual mode and extensive plans were formulated during 1969 to update our chemical feed systems and instrumentation. Future plans also include automating filter washing operations. Existing equipment service life has been longer than good engineering practice allows, and has remained in service only as a result of the application of extensive maintenance time. In practically all cases, equipment has become obsolete and replacement parts unobtainable. This especially applies to the original Control Room instruments.

Modernization will also include additional structural facilities for equipment and personnel. These needs have become quite apparent lately due to increased pumping requirements and additional equipment installed for the new basins and filters which were formally dedicated in 1967.

LOW LIFT PUMPAGE

The South Water Filtration Plant pumped a total of 141,779 million gallons (mil gal) of raw water from Lake Michigan, utilizing both raw crib and raw shore supplies, during 1969. This represents an average pumpage of 388 million gallons per day (mgd).

The total pumpage was 3.0% less than the all time record pumpage of 146,186 mil gal achieved in 1968. Weather played an important role in moderating plant pumpages. In 1969 there were only 17 days on which the thermometer rose to 90° F. or above, compared with 26 days in an average year. The months of April, May, June and July were unusually wet months. Rain fell on 24 days in June establishing a new rainfall record for that month. Listed below are the pumpage figures for the last five years of South Water Filtration Plant operation:

Year	Total (mil gal)	Average (mgd)
1965	136,895	375
1966	142,084	389
1967	141,107	387
1968	146,186	399
1969	141,779	388

The pumpage for August broke the all time monthly pumpage record by 1.1% over the previous record pumpage of July 1966. This may be attributed to the sustained high temperatures and lack of precipitation during August. Daily maximum temperatures were in the 80's on 25 days of the month and in the 90's on three days of the month.

No maximum daily pumpage records occurred during the year. However, the 1966 "hour" pumpage record was also exceeded this year on July 16th when the rate was 825 mgd for the hour ending at 1900. The high temperature for that day was 95° F. and the preceding six days had temperatures in the high 80's or 90's. The previous record hour pumpage rate was 808 mgd established in 1966.

Summary of Peak Low Lift Pumpages

Year	Month (mil gal)	Day (mil gal)	Hour (mgd)
1965	14,241 (July)	588 (7/23)	721 (7/23 @ 1500)
1966	15,589 (July)	609 (7/25)	808 (7/25 @ 2100)
1967	13,868 (August)	539 (8/17)	713 (6/3 @ 2000)
1968	15,335 (August)	640 (7/16)	772 (7/15 @ 1400)
1969	15,754 (August)	610 (7/16)	825 (7/16 @ 1900)

CHEMICAL TREATMENT AND FEEDING EQUIPMENT

Every effort was made as usual to maintain adequate chemical dosages and utilize the more efficient application points.

A most significant fact is that the treatment chemical cost per mil gal for 1969 amounted to $5.54, a 22% decrease, as compared to $7.10 per mil gal for 1968, although the cost of some chemicals increased. This is the lowest chemical cost per million gallons since 1956 when a $4.53 per mg existed.

However, raw water quality was slightly better in 1969 than in 1968. It was necessary to treat odors of the chemical and hydrocarbon type on 36 days in 1969, whereas in 1968 the same type odors occurred on 57 days. To efficiently treat raw water with these odors, the odor adsorbing chemical - carbon - was applied where it would do the most good. When these odors appeared in the raw crib supply the bypass pre-feed of carbon was initiated to give the carbon time to absorb odors before other treatment chemicals were applied. Proposed updating plans call for a short pre-feed of carbon stipulation.

Treatment Chemical Costs Per Million Gallons

1965	$5.78
1966	7.10
1967	7.16
1968	7.10
1969	5.54

Average Dosages of Treatment Chemicals Applied

	1968 lbs/mg	1969 lbs/mg
Chlorine	21.3	16.1
Alum	105	102
Iron	117	105
Calcium Oxide (Lime)	34	37
Carbon	33	18
Ammonia	1.8	1.9
Fluorine	6.6	7.1

The above figures are based on quantity of water treated with the particular chemical.

The application of fluorine was interrupted from January 14 to January 24 due to short available supplies of the hydrofluosilicic acid on the market.

South Water Filtration Plant received 1013 shipments of treatment chemicals compared to 1152 in 1968. Approximately 89% of the deliveries were made by truck and 11% by rail. Pebble lime by truck deliveries was initiated in 1969 and amounted to 25% of the pebble lime delivered. Truck deliveries of lime proved to be faster, more dependable and easier to unload. The use of larger 30 ton airslide cars for carbon deliveries reduced the total shipments as well as the delivered costs per ton of carbon.

Considerable effort was expended by senior Filtration Engineers providing proposals for design of new automated chemical feed systems. Proposals for new systems were submitted for all chemicals.

CHEMICAL CONTROL LABORATORY

The Chemical Control Laboratory performs routine chemical and physical analyses of raw, process and distribution waters. Test results from the Control Laboratory will indicate when changes in water treatment are required. A total of 140,553 chemical and physical tests were performed in 1969.

In addition to the routine analyses necessary for plant operation, the Control Laboratory performs required specification analyses on all water treatment chemicals except alum and carbon. These are performed by the Water Purification Laboratory but the alum will be assumed here in 1970. Necessary analyses were performed on 443 other chemical shipments. This totaled 1809 tests.

Summary of Water Quality

	RAW			OUTLETS
	Avg.	Max.*	Min*	Avg.
TURBIDITY (J.T.U.)	8	64	1	0.0
ODOR THRESHOLD	4E	20Ch	3E	1M
pH	8.41	8.73	8.00	8.05
NH_3N (ppm)	0.02	0.25	0.00	---
TEMP. °F	49°	72°	32°	---
FLUORIDE (ppm)	0.14	0.34	0.00	0.97
TOTAL CHLORINE RESIDUAL (ppm)	---	---	---	0.84
PLANKTON (per ml)	1900	7400	100	1
COLIFORM BACTERIA Per 100 ml	59	2400	0	0.0

*Maxima and minima of any one individual test in each category.

RAW WATER AND OUTLET WATER QUALITIES

The quality of raw water the year 1969 was an improvement over the raw water quality of past years. Except for a 7-day period in January, during which the highest odor threshold (20 Ch) occurred, and a 5-day period in December, the number of occurrences and duration of hydrocarbon odors were less than for past years.

The following is a five year summary of the number of days of odor occurrences of the chemical and hydrocarbon types on the raw water supplies. The Raw Header represents the water actually being treated, whether it was from just the crib supply or a mixture of crib and shore raw water supplies.

	1969	1968	1967	1966	1965
Raw Water Header	36	57	94	95	46
Raw Crib	33	55	67	54	33
Raw Shore	37	61	74	78	37

Treatment Chemical Costs Per Million Gallons

1965	$5.78
1966	7.10
1967	7.16
1968	7.10
1969	5.54

Average Dosages of Treatment Chemicals Applied

	1968 lbs/mg	1969 lbs/mg
Chlorine	21.3	16.1
Alum	105	102
Iron	117	105
Calcium Oxide (Lime)	34	37
Carbon	33	18
Ammonia	1.8	1.9
Fluorine	6.6	7.1

The above figures are based on quantity of water treated with the particular chemical.

The application of fluorine was interrupted from January 14 to January 24 due to short available supplies of the hydrofluosilicic acid on the market.

South Water Filtration Plant received 1013 shipments of treatment chemicals compared to 1152 in 1968. Approximately 89% of the deliveries were made by truck and 11% by rail. Pebble lime by truck deliveries was initiated in 1969 and amounted to 25% of the pebble lime delivered. Truck deliveries of lime proved to be faster, more dependable and easier to unload. The use of larger 30 ton airslide cars for carbon deliveries reduced the total shipments as well as the delivered costs per ton of carbon.

Considerable effort was expended by senior Filtration Engineers providing proposals for design of new automated chemical feed systems. Proposals for new systems were submitted for all chemicals.

CHEMICAL CONTROL LABORATORY

The Chemical Control Laboratory performs routine chemical and physical analyses of raw, process and distribution waters. Test results from the Control Laboratory will indicate when changes in water treatment are required. A total of 140,553 chemical and physical tests were performed in 1969.

In addition to the routine analyses necessary for plant operation, the Control Laboratory performs required specification analyses on all water treatment chemicals except alum and carbon. These are performed by the Water Purification Laboratory but the alum will be assumed here in 1970. Necessary analyses were performed on 443 other chemical shipments. This totaled 1809 tests.

Summary of Water Quality

	RAW			OUTLETS
	Avg.	Max.*	Min*	Avg.
TURBIDITY (J.T.U.)	8	64	1	0.0
ODOR THRESHOLD	4E	20Ch	3E	1M
pH	8.41	8.73	8.00	8.05
NH_3N (ppm)	0.02	0.25	0.00	---
TEMP. °F	49°	72°	32°	---
FLUORIDE (ppm)	0.14	0.34	0.00	0.97
TOTAL CHLORINE RESIDUAL (ppm)	---	---	---	0.84
PLANKTON (per ml)	1900	7400	100	1
COLIFORM BACTERIA Per 100 ml	59	2400	0	0.0

*Maxima and minima of any one individual test in each category.

RAW WATER AND OUTLET WATER QUALITIES

The quality of raw water the year 1969 was an improvement over the raw water quality of past years. Except for a 7-day period in January, during which the highest odor threshold (20 Ch) occurred, and a 5-day period in December, the number of occurrences and duration of hydrocarbon odors were less than for past years.

The following is a five year summary of the number of days of odor occurrences of the chemical and hydrocarbon types on the raw water supplies. The Raw Header represents the water actually being treated, whether it was from just the crib supply or a mixture of crib and shore raw water supplies.

	1969	1968	1967	1966	1965
Raw Water Header	36	57	94	95	46
Raw Crib	33	55	67	54	33
Raw Shore	37	61	74	78	37

Turbidity of incoming Lake Michigan water reached a maximum (64 J.T.U.) during the last week in March; however, the yearly average of 8 J.T.U. indicates an improved raw water quality.

The processed outlet water was of the highest quality in 1969. Excellent control was maintained on feeding of water treatment chemicals. One problem with chemicals which arose was a shortage of hydrofluosilicic acid (fluoride). For a period of nine days in January, no fluoride was added.

RAW WATER SUPPLY

Periodically during the year the percentage of the total flow rate from either the crib or shore supply was adjusted by manipulation of intake port and shaft gates so the better quality of raw water available was utilized and in order that pump suction levels could be maintained at the highest possible level to reduce pumpage costs.

The raw crib supply was utilized on 365 days of the year and the raw shore supply was utilized on 339 days of the year. A constant alert is maintained by the Filtration Plant and Dunne Crib Personnel to insure an uninterrupted flow of raw waters into plant intakes.

ALEWIFE AND ALGAE

In preparation for the annual alewife run, the intake screens at the plant and at Dunne Crib were lowered March 31 and March 22 respectively. The intake screens at the plant were raised, inspected and cleaned if necessary, every Monday, Wednesday and Friday from March 31 through December 5, when they were again raised for the winter season. Installation of a high pressure pump and pipe header near the screens aided considerably in clearing the screens. Heavy concentrations of alewife were encountered during the period middle April through late July after which the concentration diminished and disappeared by early September. 37,331 pounds of fish were removed from plant waters during the year. July was the maximum month with 13,659 pounds removed. July 21 was the maximum day with 3,170 pounds (3 day accumulation) removed.

The aquatic weed (Cladaphora most prevalent) density first appeared heavy (based on screen restriction of 20% plus) in middle May for two days; then again from June 9 through July 11, July 30 through August 2 and October 15 through October 17. Continuous checking and cleaning of the screens prevented any operational problems. The newly installed high pressure cleaning facility was an invaluable asset.

ANCHOR ICE

In preparation for the winter season and the inevitable anchor ice, screens in the plant intake and at Dunne Crib were raised in early December for the 68-69 season and December 5 and November 30, for the 69-70 season. The first report of ice formation was received from the crib on December 30 when surface ice began forming in their well.

Anchor ice was first noted in the plant on December 31 and ice formation of varying degree was prevalent through January 12. Following this period, anchor ice was noted during January 25 through 26 and February 3 through 5. Surface ice was reported at the crib during the following periods: December 30 to January 19, January 26 to 28, February 2 to 4 and February 12 to 18.

Dynamite was used at the crib on January 9, 10, 11 and 26 to break up surface ice and clear channels. No dynamite was used at the plant. Pumping of underarea water to the south intake and steam application at port gates were both initiated when deemed necessary.

Installation of two port gate butterfly valves in the north intake plus a 4" high pressure steam line and 2" steam perimeter grids at the valves were installed prior to the beginning of the 69-70 anchor ice season. However, as of the end of the year the steam system had not yet been utilized.

FILTER OPERATIONS

In 1969 there were 23,918 filter washes which required 1971 million gallons of filtered water. This wash water amounted to 1.4 per cent of the total water pumped. The maximum number of filter washes in one day was 160 and occurred on July 26, 1969. Filters Operations are summarized in Table SWF-AR-5. Comparative data of previous years is supplied below:

	1969	1968	1967
Average No. of Filters in Service	117	114	114
Average No. of Filter Washes per day	66	85	63
Max. No. of Filter Washes for One Day	160	274	207
Total Filter Washes	23,918	31,287	22,860
Average Length of Filter Runs (Hrs.)	42.3	32.0	43.5
Wash Water Usage (mil gal)	1971	2562	1787
Percent of Low Lift Pumpage Used for Wash Water.	1.4	1.8	1.3

Major Filter Building Projects

1. Four sixteen inch butterfly valves were installed in galleries one through four inclusive. They serve as header valves on the surface wash water system. As of year's end, these have not yet been automated electrically.

2. Two twelve inch hydraulically operated wafer butterfly valves were installed on surface wash water lines of filters 9 and 28 inside the filters.

3. Six sets of filter table four-way valves were replaced in the original consoles of filters 11, 12, 71, 73 and 76.

4. Two thirty inch hydraulically operated butterfly valves were installed on backwash water lines of filters 77 and 80.

5. Ten sets of adjustable anchor rods were fabricated and installed on thirty inch cast iron tees of wash water system in filter gallery four.

6. The outlet tunnel shafts', 73rd and 79th, Flow Meters were adjusted and calibrated to provide accurate flow rates. The 79th and 73rd Street outlet land tunnels were taken out of service, one at a time, for this purpose.

7. Plant engineers submitted proposals for new Master Filter Rate Controllers to replace 25 year old units in filter galleries one through four. Each controller governs flow rate of twenty rapid sand filters.

8. Forty static switches were installed on filter level control relays of filters 81 - 120 inclusive, galleries five and six. This installation was required to alleviate effect of the electrical current in the mercury manometers which was resulting in malfunction of filter level control assemblies.

9. The primary pneumatic lines of instrument air supply of galleries five and six were revised to isolate the gallery instrument systems.

10. Filter bed san elevation and gravel distribution surveys were completed on all 120 filters. A statistical analysis of [illegible] was in progress at year's end.

PLANT ADDITION

A new structure was erected adjacent to the southwest section [illegible] Chemical Building. It will house a new Control Room and Filt[illegible] Engineer V. Office. The area previously occupied by the Control Room and Control Laboratory was refurbished. This section of the original building will house the new Control Laboratory, the Che[illegible] Analysis Laboratory and the Laboratory Office. Construction of the new building and a refurbishing of the old building section was accomplished under one contract.

The Control Room and Control Laboratory had to be relocated to temporary quarters during the above. The temporary Control Laboratory was relocated to a previously occupied operating engineers' locker room. The Control Room Panel was moved in an 8 hour period without interruption of the instrument functions. The Control Room is utilizing a section of the plant machine shop as temporary quarters.

Senior Filtration Engineers participated in proposing instrumentation for the new Control Room Panel. The instrumentation will be of the latest design. The panel will consist of the following sections: Status, Levels, Flows (including operating data telemetered fro[illegible]

South Side Pumping Stations), Chemical Feeds, Analyses and Miscellaneous section which will include weather instruments. The panel will include over 100 instruments and annunciators. At year's end, specifications and drawings had been constructively commented upon with the hope that the Control Room Instrumentation Contract would be let early in 1970.

Plant Personnel participated in the lay-out of required equipment for the Control Laboratory. The layout of equipment and supplying of the utilities dimensions occupied a great deal of South Water Filtration Plant personnel's time. By year's end the laboratory equipment contract was ready to be let for bids.

WESTERN AVENUE RESERVOIR

The reservoir was used from May 29 to November 2. It was used later in the year than usual because of the dewatering line revisions in the S.W.F.P. pump suction headers. Some low lift pumps were not available for service during these revisions. The pumpage capacity was limited also due to this work and the reservoir was, therefore, used to supplement plant pumpage. The following represents the amount of water pumped from the reservoir in the last five years.

Year	Total Water Pumped (mil gal)
1965	854
1966	1,193
1967	1,061
1968	1,797
1969	1,926

GENERAL

1. All five settling basins were taken out of service, inspected, cleaned and maintained twice in 1969 with the exception of Basin 3 which was out of service on three different occasions. Basin 3 was first out of service from November 3, 1968 to March 4, 1969, during which time revisions in the metering channel for installation of a new flowmeter, installation of the flowmeter, installation of stairways at Columns 18 and 35, installation of access doors through the Column 18 slotted walls (both levels) and cutting of an access opening in the curtain wall at Column 35 were accomplished.

2. It was necessary to take Basin 3 out of service for the second time when it was discovered that the west cross collector (drag chain and flights) were damaged by a large piece of spalled concrete that had fallen from a column cap and found its way into the collector trench. Following cleaning in October, both Basin 3 cross collectors were rebuilt with new drive chain assemblies, drag chain, sprockets, bearing and flight wear shoes. The majority of the Column 18 slotted wall boards were also replaced at this time.

3. Basin 1 was first out of service from March 2 through May [illegible] the same revisions, cited in item 2 above, accomplished in Basin 3. Basin 2 was taken out of service for the second time on November 9 and was still out at the end of the year for the same revisions as Basins 1 and 3 plus the replacement of all scraper and cross collector drag chain, drive chain, sprockets, bearings and flight wear shoes, and completion of training walls between Columns 18 and 19.

4. Number 1 Low Lift Pump was overhauled with rebuilt bearings, new wear rings, new shaft sleeves and refaced casing rings.

5. Two complete bays of submerged flocculator bearings were also replaced in Basin 1 (rapid mix and one slow mix line). This replacement plus the receipt of 16 new bearings and the remetalizing and reconditioning of existing used spools and housings, respectively, is the first step in a program for replacing all flocculator bearings in Basins 1, 2 and 3.

6. Continuous problems were experienced during the year with Basin 4 and 5 mixing equipment. Basin 4 Rapid Mix Shaft was aligned. An alignment check of Basin 4 Slow Mix shafts indicated that they were badly out of line. Basin 4 and 5 Gallery Mixer Drive assemblies were checked and realigned where necessary. Three reduction gears failed and were replaced with spare units or overhauled units that had previously failed. New larger capacity Rapid Mix drive assemblies determined to be necessary were delivered, in [illegible] not installed by the end of the year.

7. The installation of a high pressure pump and piping system to improve intake basin screen cleaning operations within plant [illegible] areas was completed in time to be of tremendous help [illegible] alewife and weed period.

8. The 16" dewatering lines in the north and south low lift pump suction headers were revised during the year to enable the dewatering of either intake basin without taking either of the pump suction headers out of service. Flexibility extends to dewatering suction headers also.

9. In October, City divers and crane operator were called upon to move four new 6' x 8' rectangular butterfly valves into the intake basins from the shore side for installation at port [illegible] 16, 17, 18 and 19. By the end of the year the two valves in the north intake were installed and manually operable. The electrical wiring for power supply to the valve operators was not yet completed. Steam perimeter grids and shore sample line piping installed between the existing port sluice gates and the new butterfly valves in the [illegible]. Also by the end of the year the steam grids were connected to an existing high pressure steam supply on -24' elevation [illegible] pump building [illegible].

10. At year's end most of the abandoned Ammonium Sulphate, Dry Alum and Pebble Lime Feed equipment, including scales, hoppers and piping, on the +24' elevation of the Chemical Building had been removed in preparation for future installations of automated chemical systems.

CONCLUSION

The shortage of technical personnel remained a problem throughout the year. Vacancies have existed and the unavailability of qualified people has been disappointing. Every effort should be expended to rectify this situation. Present personnel have extended themselves to fill these voids more than can be reasonably expected.

Low lift pumpages maintained the previous years trend toward increases and some new records were established in this category. Plans are being formulated to increase the plant pumpage capacity and will be expedited in the near future.

Increased awareness of chemical costs and diligence in supervision of chemical dosages have resulted in a sizeable dollar savings for treatment chemicals. The cost per million gallons has been the lowest since 1956 not withstanding the increase in chemical costs the past 13 years. Due credit should be given to all plant personnel in establishing this enviable record.

SOUTH WATER FILTRATION PLANT SWF - AR 1

EXPENDITURES - 1969

ACCOUNT	COST	PERFORMANCE COST $/PER MIL GAL.	
Salaries and Wages	$1,820,834	$12.84	
Overtime	3,857	.03	
Vacation Relief	10,298	.07	
Total For Personal Services	1,834,989		$12.94
Office and Building Services	1,863	.01	
Repair or Maintenance of Property	66,652	.47	
Repair or Maintenance of Equipment	65,911	.46	
Natural Gas (Peoples Gas)	20,114	.14	
Electric Power (Commonwealth Edison)	203,983	1.44	
Other	12,988	.09	
Total for Contractual Services	371,511		2.61
Fuel Oil	28,345	.20	
Repair Parts, Material and Supplies	85,947	.61	
Chemical Material and Supplies	795,546	5.61	
Apparatus and Instruments	2,357	.02	
Other	5,240	.04	
Total For Commodities	917,435		6.48
Security Services	41,056	.29	
Total for Security Services	41,056		.29
TOTAL FOR OPERATION AND MAINTENANCE	$3,164,991		$22.32
Capital Expenditures:			
Machinery and Equipment	20,382		
Vehicles, Office Equipment, Etc.	9,657		
Total For Equipment	30,039		
TOTAL EXPENDITURES	$3,195,030		

Performance cost based on Low Lift Pumpage of 141,779 mil. gal.

SOUTH WATER FILTRATION PLANT
SUMMARY OF ELECTRIC POWER COSTS
1969

MONTH	LOW LIFT PUMPAGE MG	TOTAL USAGE KWH	TOTAL COST $	COST PER KWH $	POWER DISTRIBUTION—KWH			PERFORMANCE COST PER MILLION GALLONS ($/MG)			
					LOW LIFT PUMPS	(A) LIGHTING & POWER	WASH WATER PUMPS	LOW LIFT PUMPS	(A) LIGHTING & POWER	WASH WATER PUMPS	TOTAL
JAN	11247	1675200	16651	0.0099	1042148	545589	87463	0.92	0.48	0.08	1.48
FEB	9931	1488000	15195	0.0102	916979	482276	88745	0.94	0.50	0.09	1.53
MAR.	10804	1593600	16108	0.0101	970288	543419	79893	0.91	0.51	0.07	1.49
APR.	10356	1502400	15659	0.0104	945174	495484	61742	0.96	0.49	0.06	1.51
MAY	11606	1584000	16916	0.0107	1022036	492587	69377	0.94	0.46	0.06	1.46
JUNE	12299	1670400	17107	0.0102	1101867	482399	86134	0.91	0.41	0.07	1.39
JULY	14304	1862400	18757	0.0101	1270858	494773	96769	0.90	0.34	0.07	1.31
AUG.	15754	1992000	19825	0.0100	1421822	493545	76633	0.90	0.31	0.05	1.26
SEPT.	12797	1699000	18090	0.0106	1155518	472785	70697	0.96	0.39	0.06	1.41
OCT.	11411	1636800	17114	0.0105	1015150	552574	69076	0.93	0.51	0.06	1.50
NOV.	10511	1564800	15885	0.0102	929169	564966	70665	0.90	0.54	0.07	1.51
DEC.	10759	1627200	16676	0.0102	961536	594078	71586	0.92	0.56	0.07	1.55
TOTAL	141779	19895800	203983		12752545	6214475	928780				
AVERAGE				0.0103				0.92	0.45	0.07	1.44

SOUTH WATER FILTRATION PLANT
SUMMARY OF CHEMICALS APPLIED
1969

MONTH	LOW LIFT PUMPAGE MG	CHLORINE		ALUM (as 17% Al_2O_3 dry)		FERROUS SULFATE (as $Fe_2SO_4 \cdot 7H_2O$ dry)		PEBBLE LIME as CaO		SULFURIC ACID as H_2SO_4		CARBON		AMMONIA (ANHYDROUS)		FLUORINE (as F)		SODIUM SILICATE (as Si_2O_2)	
		TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG	TOTAL lbs	DOSAGE lbs/MG
JAN	11247	253326	16.0	676344	93	448940	104	463856	41			580793	48	17433	1.5	55627	4.9		
FEB	9931	165727	12.2	528280	80	286621	87	350901	35			142649	14	14849	1.5	67637	6.8		
MAR	10804	171457	12.5	764548	96	268166	95	373331	35			161871	15	15311	1.4	76020	7.0		
APR	10356	225515	16.6	908533	120	375216	134	493230	48			181347	18	20621	2.0	74228	7.2		
MAY	11606	235656	16.1	1072422	120	347305	128	413733	36			143708	12	18377	1.6	83416	7.2		
JUNE	12299	282522	16.4	878862	121	562834	112	408497	33			131632	11	17925	1.5	91033	7.4		
JULY	14304	344038	20.7	1216243	110	348567	109	577936	40			171124	12	36489	2.6	108060	7.6		
AUG	15754	353722	18.4	1321644	112	448859	114	572055	36			166009	11	44114	2.8	121487	7.7		
SEPT	12797	283779	17.1	752826	96	494475	100	415882	32			163838	13	29652	2.3	93198	7.3		
OCT	11411	261600	17.5	631300	96	478300	99	436100	38			163400	14	27090	2.4	80950	7.1		
NOV	10511	202600	14.5	568600	89	384300	93	406000	39			197200	19	19090	1.8	77350	7.4		
DEC	10759	189400	14.7	701700	87	237000	88	327500	30			339200	32	20600	1.9	80550	7.5		
TOTAL	141779	2969300	16.1	10021300	102	4680600	105	5238900	37			2542600	18	281540	1.9	1009600	7.1		

SWF – AR. 4

SOUTH WATER FILTRATION PLANT
SUMMARY OF CHEMICAL COSTS
1969

MONTH	LOW LIFT PUMPAGE MG	CHLORINE		ALUM (as 17% Al_2O_3 dry)		FERROUS SULFATE (as $FeSO_4 \cdot 7H_2O$ dry)		PEBBLE LIME as CaO		SULFURIC ACID as H_2SO_4		CARBON		AMMONIA (ANHYDROUS)		FLUORINE (as F)		SODIUM SILICATE (as SiO_2)		TOTAL COSTS $	TOTAL COSTS $/MG
		COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG	COST-$	COST $/MG		
JAN	11247	12485	1.11	13602	1.21	5924	0.53	4526	0.40			51226	4.56	475	0.04	5667	0.50			93905	8.35
FEB	9931	7960	0.80	10619	1.07	3782	0.38	3424	0.34			12566	1.27	477	0.05	6499	0.65			45327	4.56
MAR	10804	8269	0.76	15362	1.42	3537	0.33	3643	0.34			14405	1.33	509	0.05	7304	0.68			53029	4.91
APR	10356	10781	1.04	18178	1.76	4951	0.48	4813	0.47			15587	1.50	606	0.06	7132	0.69			62048	6.00
MAY	11606	11222	0.97	21678	1.87	4502	0.39	4037	0.35			12965	1.12	503	0.04	8017	0.69			62924	5.43
JUNE	12299	13555	1.10	17853	1.45	7030	0.57	3985	0.32			11626	0.95	528	0.04	8746	0.71			63323	5.14
JULY	14304	16476	1.15	24071	1.68	4354	0.31	5639	0.39			15114	1.06	830	0.05	10384	0.72			76868	5.36
AUG	15754	17092	1.08	26892	1.71	5606	0.36	5581	0.35			14662	0.93	1088	0.07	11495	0.73			82416	5.23
SEPT	12797	13695	1.07	15315	1.20	6173	0.48	4057	0.32			14372	1.12	786	0.06	8972	0.70			63370	4.95
OCT	11411	12675	1.11	12797	1.12	5971	0.52	2791	0.24			14444	1.27	771	0.07	7793	0.68			57242	5.01
NOV	10511	9709	0.92	12509	1.19	4798	0.46	3959	0.38			17371	1.65	506	0.05	7446	0.71			56298	5.36
DEC	10759	9179	0.85	15437	1.43	2959	0.28	3195	0.30			29796	2.77	549	0.05	7755	0.72			68870	6.40
TOTAL	141779	143098	1.01	204313	1.44	59587	0.42	49650	0.35			224134	1.58	7628	0.05	97210	0.69			785620	5.54

SWF – AR. 5

SOUTH WATER FILTRATION PLANT
SUMMARY OF OUTLET FLOWS AND FILTER OPERATIONS
1969

MONTH	LOW LIFT PUMPAGE MG	OUTLET TUNNELS			FILTERS				
		73rd St. MG	79th St. MG	TOTAL MG	UNITS IN SERVICE	UNITS WASHED	AVG. FILTER RUNS—HRS.	WASH WATER USED	
								MG	%
JAN.	11247	5003	5399	10402	3685	2465	35.7	192	1.7
FEB.	9931	4366	4715	9081	3334	2401	33.1	201	2.0
MAR.	10804	4822	5202	10024	3683	1946	44.9	163	1.5
APR.	10356	4345	5493	9838	3396	1552	52.4	114	1.1
MAY	11606	5194	6743	11937	3710	1911	46.4	136	1.2
JUNE	12299	5935	6578	12513	3502	2321	36.0	184	1.5
JULY	14304	6955	7355	14310	3548	2252	26.6	228	1.6
AUG.	15754	7671	8266	15937	3584	1921	44.6	177	1.1
SEPT.	12797	6170	6781	12951	3457	1624	50.9	148	1.2
OCT.	11411	5270	6044	11314	3383	1692	47.9	143	1.2
NOV.	10511	4661	5632	10293	3509	1891	44.4	144	1.4
DEC.	10759	4782	5830	10612	3658	1942	45.1	141	1.3
TOTAL	141779	65174	74038	139212	42449	23918		1971	
AVG.	11815	5431	6170	11601	3537	1993	42.3	164	1.4
MAX.	15754	7671	8266	15937	3710	2465	52.4	228	2.0
MIN.	9931	4345	4715	9081	3334	1552	26.6	114	1.1

WATER PURIFICATION LABORATORY SECTION

Benjamin F. Willey

Director

Analytical and investigative services of the Water Purification Laboratory continued on an upward trend during 1969. Each of the three units showed an increase in the number of tests performed with the total number of tests rising to 232,512 in all three areas. This is an increase of 8.1% over 1968.

The increase in work was performed with no increase in staff size and can be attributed largely to benefits derived from improved methodology and the wider application of instrumental methods of analyses.

MICROBIOLOGY

Although this unit showed the least increase in number of tests performed (2,187) over 1968, the improved reliability and more rapid reporting of results using the membrane filter technique provided a marked improvement in services to both plants and the Water Quality Surveillance Section. Some time was allocated to further improve methods. Although, still in the research stage some show promise for even greater improvements in methodology in another year or two.

ELECTRON MICROSCOPY

Electron Microscopy showed the largest percent increase in test parameters run recording a jump from 5,338 in 1968 to 10,137 in 1969. Most of this work was in the area of detection and testing of odor producing organisms of the order Actinomycetales. Expanded use of specialized light microscopy supplimented the diversified electron microscopic studies regularly carried on in this unit.

CHEMISTRY

Chemistry provided the largest increase in number of tests performed (10,380 more than 1968), with a percentage increase of approximately 14%. The increase was made possible largely through more extensive application of the sophisticated instrumentation provided by the City for detailed pollution study work. Several new parameters were added to the list of tests regularly performed to increase our knowledge and surveillance of trace pollutants in Lake Michigan. The Technicon Autoanalyzer, Coleman 124 Double Beam Spectrophotometer and the Atomic Absorption instrument have proven to be of exceptional merit in improving both the quantity and quality of the analytical work performed during 1969.

JOHN R. BAYLIS MEMORIAL LIBRARY
and
TECHNICAL INFORMATION CENTER

During 1969 the Technical Library and Information Center came much closer to accomplishing its planned goals, although the formal dedication of the Library as the John R. Baylis Memorial Library was rescheduled for the spring of 1970 because of unexpected delays in receiving the library furniture, catalog cards and books.

The last of the library furniture, the shelving and card catalog were installed

in the Library and magazines, bound periodicals and other materials were cataloged and shelved or filed as appropriate. Library of Congress catalog cards were ordered for all books, and the books were cataloged and shelved for circulation as the cards were received. Over 320 volumes were checked and sent to the bindery for binding and cataloged and shelved when returned. Additional books, periodicals and other technical material were requisitioned and after cataloging were shelved for circulation as received.

Approximately 300 mail and phone requests for informational material were processed, including many student requests for information on water pollution and the Chicago Water System, and more specific requests such as those for detailed data on fluoridation and water treatment and pollution. Additional library services were provided on a greatly increased level during the year and will continue to be expanded as more books, periodicals and other materials are received and cataloged.

Information Center personnel also handled the Division Varityping and Xeroxing, Multilithed and assembled all Division and most Bureau and Department forms and publications, and printed, assembled and distributed two issues of Pure Water.

MICROBIOLOGY UNIT REPORT

Changes in laboratory procedures, adjustments, and revisions in sampling procedures for better correlation of results were made during 1968. These corrections served well during 1969 and no further significant changes were necessary either in procedures or sampling. The work load therefore, remained steady and analytical parameters and number of tests rose only slightly above that of the previous year.

Raw water samples were tested by the Multiple-tube Dilution Method (MPN). All treated waters were tested by the Membrane Filter (MF) Technique. Some pollution samples were run using both methods of determining coliform organisms. Where indicated samples were also run for fecal coliform and fecal streptococci. Plankton organisms were continued to be examined at 200 magnifications for more complete identification. Total tests run reached a new high of 139,334 in the Microbiology Unit, an increase of 2,187 over 1968.

POLLUTION SURVEILLANCE

The total number of pollution surveys (including Hammond) was 390, with lake surveys remaining about the same as in 1968. Microbiological parameters remained as in 1968 except in the area of odor producing organisms, where the work was assigned primarily to the Electron Microscopy Unit with some assistance from the Microbiology Unit staff being provided in the summer months.

PLANKTON

The general trend toward lower counts for the past several years continued again in 1969, both from the standpoint of averages and maximums. Over the past five years only 1968 showed a break in the downward trend.

Diatoms were low only in July (47% at Central Shore Intake, 57% at the Dunne Crib and 53% at the South Plant Shore Intake), but in all other months diatoms never dropped below 78% of the total number of plankton organisms found. Dino-

bryon monthly averages were up slightly. This organism seemed to be distributed more uniformly over the entire year in 1969, whereas, in the past they were concentrated primarily in July and August.

SPECIAL PROJECTS

Projects initiated in 1968 to enhance the reliability of methods, media and techniques were continued on a routine or semi-routine basis as time would permit. This included testing for bactericidal properties of distilled water, control of media and reagents and evaluation of equipment and materials. Ultraviolet sterilization of membrane filter apparatus became the practice after a period of intensive testing. Equipment of our own design and construction was installed and is performing in excellent manner.

Bacterial Study of Pipe Joint Compound

At the request of the Chief Water Engineer, a sample of pipe joint compound was tested for bacterial nutrients. It was found that the compound supported and enhanced growth of microorganisms.

Fluorescent Antibody Technique

A project was started late in 1968 and carried on periodically during 1969 to study the easibility of combining the Membrane Filter with fluorescent antibody technique so that results could be obtained in much shorter time than is presently possible using the Membrane Filter alone. Thus far the work has not progressed far enough to permit an evaluation as to its success or failure

Sampling of Canteen Products

Samples of soft drinks and coffee from canteen dispensers were submitted to the laboratory for testing. The work resulted in cleaning of some machines and the replacement of one.

YEARLY RESULTS

There was a decrease of some 780 samples (all plankton) over 1968. This 4% reduction was due to adjustments in the sampling schedules

Coliform MPN per 100 ml-Average

Raw Water (Shore Water)

	1968	1969
Average	120	100
Maximum Daily Average	12,000 (8-17)	4,400 (8-24)
Maximum Sample	16,000 (8-17)	24,000 (8-6)
Minimum Daily Average	0 (5/12, 13)	0 (9 days)
Minimum Sample	0	0

Settled Water (Average of four quadrant-MF)

Average	0.22	0.08

Outlets - (Average of four quadrant-MF)

Average	0.0035	0.007

Plankton Organisms-per ml (results from Composite of three samples)

Raw Water Shore	1968	1969
Average	2,800	2,000
Maximum Average	14,000 (7-16)	10,500 (3/9)
Minimum Average	130 (1/5)	80 (8/4)
Basins (Average of four quadrants)		
Average	180	120
Percent Reduction	93.5%	94.0%
Clearwells (Average of four quadrants)		
Average	4.3	2.0
Percent Reduction	99.9%	99.9%
Yearly Percent Breakdown	**1968**	**1969**
Diatoms	91.0	91.5
Myxophyceae	2.3	3.4
Chlorophyceae	1.8	1.2
Pigmented Flagellates (Dinobryon)	3.3	2.8
Protozoa	1.2	1.0
Misc. Organisms	0.4	0.1

South Water Filtration Plant

In 1969, there was about a 3% increase in samples and tests. The annual average of Shore water was lower than the Crib average, which was unusual.

Coliform per 100 ml - Average	Crib	Shore
Raw Water - MPN	25.0	18.0
Maximum Daily Average	980 (1/24)	720 (1/24)
Maximum Sample	5,400 (1/24)	1,700 (1/23, 1/24)
Minimum Daily Average	0 (1/13, 5/14)	0 (38 days)
Minimum Sample	0	0
Settled Water - Average MF per 100 ml		
Average of five basin samples	Jan. - Feb.	0.01
Average of four Clearwell samples	March - Dec.	0.01
Outlets (Average of 73rd and 79th) - MF per 100 ml		
Average		0.03

Plankton Organisms - per ml (results from composite of three samples)

Raw Water	Crib	Shore
Average	1,600	2,000
Maximum	6,200 (4/11)	13,000 (4/22)
Minimum	20 (8/4)	60 (8/4)
Basins (Average of five basins)		
Average		120
Percent Reduction		93.3%
Clearwells (Average of three pairs)		
Average		1.4
Percent Reduction		99.9%

Yearly Percent Breakdown	1968	1969	1968	1969
	Crib		Shore	
Diatoms	93.0	92.0	94.0	93.0
Myxophyceae	1.9	3.6	2.0	3 2
Chlorophyceae	0.7	1.0	0.5	1 5
Pigmented Flagellates (Dinobryon)	3.0	2.7	2.1	2 1
Protozoa	1.0	0.5	1.0	0 3
Misc. Organisms	0.7	0.1	0.4	0 1

SUMMARY OF SAMPLES AND TESTS

	CWFP		SWFP		WQSS		TOTAL	
	1968	1969	1968	1969	1968	1969	1968	1969
Bacterial Samples	12,146	12,150	13,570	13,927	20,216	19,143	45,932	45,220
Bacterial Tests	32,878	31,796	36,010	37,210	60,519	63,284	129,407	132,290
Plankton Examinations (Samples & Tests)	3,977	3,289	3,544	3,500	219	255	7,740	7,044
Total Samples	16,123	15,439	17,114	17,427	20,435	19,398	53,672	52,264
Total Tests	36,855	35,085	39,554	40,710	60,738	63,539	137,147	139,334

SUMMARY OF LAKE POLLUTION SURVEILLANCE
(Included under W.Q.S.S. column above)

	1968	1969
Number of Lake Surveys	68	41
Small Boat Harbors	47	23
North Shore including Radial	8	8
South Shore including Radial	9	6
Land Surveys	3	3
Miscellaneous	1	1
Calumet River and Canal	#	51
Chicago River	#	52
Hammond	#	249
Total Number of Surveys	#	393
Total Number of Samples	2,270	2,476*
Total Number of Tests	12,261	16,624*

* Includes 99 beach samples.
\# Figures not available.

ELECTRON MICROSCOPY UNIT REPORT

During the year 1969, all the usual routine examinations and operations were maintained daily. Samples were collected from treated and untreated water from both plants and examined with the Electron Microscope for the presence of various microorganisms, crystalline matter and floc formation.

A preliminary study of minute particles which pass through 0.45 microns, retained on and passed through 50 millimicron size millipore filter has been initiated. Primary interest is in particles ranging from 25 millimicrons to 150 millimicron size and suggesting organic matter.

In Spring, several complaint samples were received for determination of the possible presence of bacteria. The Nematode Survey continued throughout the year. Raw water samples from the Header and Shore at SWFP and Raw Shore from CWFP were collected for this purpose.

A working technique was initiated for obtaining pure cultures of growth by directly placing previously prepared screens on the agar plates. After several days the screens were Chromium shadowed and examined under the Electron Microscope.

A series of photomicrographs were obtained by taking pictures in increments at different focal planes. This process was necessary for obtaining focus data and sharp images at different planes throughout the organisms. This study was made possible by the addition of a newly purchased permanent aperature for the Electron Microscope.

The studies of Actinomycetes and other related fungi continued during the year. Different selective media were used to develop techniques for culturing, isolating and maintaining of these organisms. An extensive research paper of these studies was submitted.

Several samples of compounds and crystalline matter extracted in the Chemistry Unit were received in the Electron Microscopy Unit for examinations under the Polarized microscope and reports were made for inclusion with their studies

During the year 1969, a total of 10,137 tests were made in the Electron Microscopy Unit (Laboratory). This is an increase of 4,799 over 1968. A breakdown of the tests follows:

I. Electron Microscopy	
1. Lactose presumptive tubes from plant	12
2. Special E.M. examinations (direct and centrifuge) treated	759
3. Special plankton identification of species	740
4. Special bacterial identifications of isolated and purified microorganisms	451
5. Various examinations of samples of miscellaneous nature	620
II. Optical Microscopy	
1. Raw water SWFP and CWFP (general and nematode counts)	757
2. Examiantions of plankton collected by plankton net or on millipore filters	916
3. Various tests and examinations of samples of miscellaneous nature	1,131
4. Special bacteriological identifications	2,005
III. Gross Microbiological and Miscellaneous Tests	2,746

CHEMISTRY UNIT REPORT

The total number of analyses performed in the Chemistry Unit of the Water Purification Laboratory, during 1969, showed and increase of nearly 15% over the 1968 total.

	Total Number of Analyses
1968	72,661
1969	83,041

This significant increase was accomplished with no corresponding increase in number of personnel. This was made possible due to a combination of two main factors, stepped up activity in respect to the number and frequency of pollution surveys combined with the development of instrumentation techniques which increased our output potential per man hour.

The functioning of the Chemistry Unit of the Water Purification Laboratory, during 1969, fell under the following principle categories:

Monitoring Raw Water Quality Including Pollution Surveillance and Analyses

Quality Control Analysis of Finished Water

Plant Support Services

Special Projects

Research and Developmental Operations

Monitoring Raw Water Quality: Daily monitoring was conducted of the quality of raw water entering the two Chicago Filtration Plants and the Hammond Pumping Station for treatment. Sixteen parameters are measured on these raw water samples.

Quality Control of Treatment Process: Analyses are performed on In-plant water at various stages of the purification process to determine the effectiveness of treatment. Finished water is sampled at the two outlets of each Filtration Plant; from the Distribution System at the Pumping Stations; at the consumer level from taps in public facilities (Service Stations, etc.) and from household taps. These are analyzed for certain significant properties to ascertain that a truly high water is maintained throughout the system.

Evaluation of Materials. Analysis of bulk materials received for use in the water purification process at the two Filtration Plants.

SEASONAL ANALYSIS

Number of Seasonals Undertaken	4
Number of Sampling Points per Seasonal	13
Number of Parameters on Each Point	52
Total Number of Tests	2,704

Samples collected for Seasonal Analysis undergo the most comprehensive analytical examination of any samples received in the Main Chemistry Laboratory. The results provide a detailed profile of the overall water system from Raw source to Pumping Stations. These Seasonal Surveys are the most reliable index available of seasonal water quality trends and of consequent variations in the raw & finished products over protracted periods.

The accomplishment of four Seasonals during a single year has long been the goal of this laboratory. The Laboratory Staff, therefore, feels pride in having accomplished this during 1969 for the first time in its history.

In conjunction with each Seasonal Analysis of the Chicago Water System a Pollution Survey of the Chicago-Calumet Area was performed. Samples from this survey were subject to the same analytical scrutiny as the Seasonal samples.

Pollution Survey Sampling Points

Hammond Pumping Station Raw Intake

Calumet River at Dickey Road

South Water Filtration Plant Raw Header

Central Water Filtration Plant Intake Basin

Calumet River Mouth at 92nd Street Bridge

Chicago Water System Sampling Points

South Water Filtration Plant: Raw "Header"

73rd and 79th Street Outlet Shafts

Roseland and Western Avenue Pumping Stations

Central Water Filtration Plant: Raw Intake Basin

North and Central Outlet Shafts

Mayfair and Central Park Pumping Stations

Composites of the 1969 Seasonals are shown in WPL Tables 2 and 3.

SURVEILLANCE OF RAW WATERS

Plant Intake Raws: Raw water samples from intakes at the two Chicago Filtration Plants and at the Hammond Pumping Station are analyzed daily in the Chemistry Laboratory for properties which are beyond the scope of the Plant Control Laboratories. Parameters measured include phenols, detergents pH, calcium, phosphates, turbidity and iron.

Total Number of Samples	990
Total Number of Analyses	12,628

Lake Surveys: The shore waters of Lake Michigan from Waukegan on the North to Hammond on the South are surveyed in two sections: (a) North Lake Survey and (b) South Lake Survey. These surveys are undertaken because the quality of water at the intakes of the Chicago Filtration Plants may be affected by water from this extensive area of lake---depending upon prevailing weather conditions, wind direction and water currents.

Total Number of Surveys (North & South)	11
Total Number of Samples	101
Total Number of Tests	806

Radial Surveys: These were designed with the Filtration Plants as the two hubs.

Total Number of Surveys	3
Total Number of Samples	75
Total Number of Tests	1,330

Precipitation Radioactivity: Following every measureable precipitation, samples are collected from five monitoring stations dispersed throughout the city. These samples are checked for Gross Beta radioactivity.

Total Number of Samples	301
Total Number of Tests	301

Pollution Surveys: Certain carefully predetermined points were routinely sampled and analyzed in our continued efforts to identify and curb sources of pollution---actual or potential. In this connection, the following surveys were conducted:

(a) Calumet Area Survey: Weekly sampling is conducted at thirteen points in the Chicago-Calumet industrial area. Samples come from the Calumet River, Indiana Harbor Ship Canal, Lake Michigan at the River Mouth, and the Raw Water Intakes at the Hammond Pumping Station and the two Chicago Filtration Plants.

Total Number of Surveys	52
Total Number of Samples	676
Total Number of Tests	8,781

(b) Chicago River Mouth: Weekly sampling is conducted at eighteen points at the mouth of the Chicago River, Ogden Slip and Lake Michigan near the River Mouth

Total Number of Surveys	54
Total Number of Samples	928
Total Number of Tests	7,979

(c) Small Boat Harbor Survey: The eight Chicago Small-Boat Harbors from Montrose on the north to Jackson Park on the south were surveyed regularly during the swimming and pleasure-craft season. This type of surveillance provided data which substantiated the need for establishing controls, governing the operations of small craft in our area waters.

Total Number of Surveys	23
Total Number of Samples	368
Total Number of Tests	3,680

QUALITY CONTROL OF FINISHED WATER

Distribution System: Samples of finished water in the Distribution System are received daily from both outlets of each of the two Filtration Plants, and three times per week from each of the eleven Pumping Stations.

Total Number of Samples	1,520
Total Number of Tests	7,450

Perimeter Survey: Thirty samples are collected once per month at preselected points on the periphery of the water distribution system. This survey permits determination of the stability of the water during the many hours that it takes to travel from the Plant Outlets to the end of the system.

Total Number of Surveys	12
Total Number of Samples	360
Total Number of Tests	2,880

Water Quality Complaints: Samples are brought in regularly by the Water Quality Surveillance Section of the Water Purification Division. Samples are generally from service taps of the complaining consumer. These are analyzed to determine if any abnormal properties exist in the sample and if so what is the nature and possible source. Seepage samples are brought in by the Water Quality Surveillance Section from basements and other low lying areas where there is an unexplained accumulation or flow of water. These are tested to determine certain properties and to verify if they arise from the City's water supply.

Total Number of Samples	260
Total Number of Tests	1,812

Quality control surveys of the finished water enable the Water Purification Division to monitor daily the quality of the water reaching the consumer from each Filtration Plant. In addition, they may provide a means of determining what changes, if any, take place during transportation of finished water through the Distribution System.

Parameters routinely checked include pH, turbidity, alkalinity, hardness, calcium, dissolved iron, fluoride, aluminum and NH_3-N.

Total Number of Tests	12,142

PLANT SUPPORT SERVICES

Plant Operations Support: The following activities were conducted in support of the day-to-day operations of the two Filtration Plants.

Water Purification Laboratory Chemists supplied the Control Laboratory at the South Water Filtration Plant with buffers and other reagents and standard solutions for use in their testing operations.

At the request of the Assistant Engineer of Water Purification a study was conducted on the Raw Intake water at the Central Water Filtration Plant to determine the relationship, if any, between turbidity and dissolved solids of the Raw lake water. This study involved 156 samples.

Coagulation jar tests were often performed when the quality of the raw water at the Central Water Filtration Plant intake was poor or when higher than normal turbidities existed in the finished water; or in evaluating various coagulation materials.

Samples of distilled water from the Microbiology Laboratory were checked for copper content and found to be copper-free.

Parallel tests with the South Water Filtration Plant's Control Lab were conducted on samples of $H_2Si\ F_6$, when for some unexplained reason the results obtained in the South Water Filtration Plant lab appeared to be incorrect.

Samples from the Enslow apparatus at the Central Water Filtration Plant are tested daily for determining the stability index of the finished water.

Analysis of Bulk Material: All raw materials received in bulk for use in water treatment processes must be pretested in order to (a) insure that they meet the specifications set forth between the city and the supplier, and (b) provide the filtration engineers with data from which proper feed rates can be calculated to attain maximum plant efficiency.

Material analyzed include Aluminum Sulfate, Ferrous Sulfate, Lime, Sodium Hydroxide, Hydrofluosilicic Acid and Activated Carbon. In addition, several new materials were evaluated from potential suppliers.

The analysis of Activated Carbon for its adsorptivity (Modified Phenol Value), moisture content, residual ash and other physical properties, remains the responsibility of the Chemistry Unit of the Water Purification Laboratory. This laboratory is also the final arbiter in cases of questionable analytical results generated in either of the Control Laboratories.

Development of new methods, modification of current procedures, assessment of new instruments and evaluation of new materials for the entire Water Purification Division are the province of the main Chemistry Laboratory.

Alum: Total number of samples	254
Alum: Total number of tests	1,778
Activated Carbon:	
Total number of samples	139
Total number tests	549
Hydrofluosilicic Acid: samples	61
Hydrofluosilicic Acid: tests	244

SPECIAL PROJECTS

Manganese in Alum: Several samples of alum and domestic and South American bauxite were analyzed to determine the manganese content of these materials.

Organics in Iron: Samples of Ferrous Sulfate were extracted with chloroform through shaking followed by separation. The chloroform extracts were then analyzed for the amount of extracted organics. This program was initiated because of the reported existence of objectionable quanities of organic inhibitors in the pickle liquor used in the production of Ferrous Sulfate by certain manufacturers.

Bottom Deposits: 195 samples of settling basin sediment were analyzed for specific gravity. Several of these samples were also analyzed for pH and percent solids.

Filtrability Index: Studies were continued on the applicability of Filtrability Index as an aid to determining optimum coagulant dosages for the treatment of Lake Michigan water.

Organic Pollutants: The program for determining organic pollutants through adsorption on granular activated carbon was expanded to include two installations at the Central Water Filtration Plant, one each on the Raw and on the Finished water. The adsorbed materials are extracted successively into chloroform (CCE) and into alcohol (CAE). These extracts are used to determine the extent of the organic pollution in our water.

Radioactivity and Membrane Filtration: A start has been made on the project to determine the extent to which radio-isotopes are truly in solution as compared to their adsorption on particulate material. Variuos pore sizes of Membrane Filters are to be tried in this study.

It is anticipated that the acquisition of an automatic counting system for radioactivity will facilitate acceleration of this program.

An extensive study was made to compare Specific-Ion Fluoride Analyzer with the colorimetric method of determining fluorides. All the evidence suggests that the Specific-Ion Fluoride Analyzer is a reliable tool and effects a considerable saving of time.

INSTRUMENTATION

Acquired: Two B and L Spectronic 20 spectrophotometers
Coleman model 124 spectrophotometer
Orion Specific-Ion Analyzer
Technicon Autoanalyzer

All of these are in extensive daily use and enhance the production rate while facilitating greater accuracy and precision of results.

Updated or Modified: Atomic Absorption Spectrophotometer was changed to solid-state electronics rendering greater stability and ease of operation
The Beckman GC4 Gas Chromatograph was modified to permit determination of pesticides.
The Multiple-Place Kjeldahl stills were converted to all-glass design to permit improved distillation of phenols and other materials.

INTERLABORATORY COLLABORATION

The Water Purification Laboratory continued to be represented at the monthly Laboratory Directors' Meeting held under the aegis of the Calumet Area Enforcement Conference. It has been represented by the Chief Chemist and one Chemist III. The group as a whole is investigating the methodology for determination of cyanides, while subcommittees are engaged in preparing reports on prior investigations of the methodology for Phosphates and for Phenols. Several "Round Robins" were conducted during 1969 in an effort to refine and standardize the procedure for Cyanides determination.

This Laboratory participated in three nation-wide Inter-Laboratory Surveys organized and conducted by the Analytical Reference Service headquartered at the Taft Environmental Engineering Center in Cincinnati, Ohio.

The subjects of the surveys were:

Water Metals No. 6 ..... Barium, Beryllium and Aluminum

Water Nutrients No. 2 ... Phosphates (ortho, poly, organic and total), Sodium Chloride, Ammonia and Nitrates

Water Physics No. 1 ..... pH, Alkalinity, Specific Conductance and Total Solids

The Chemistry Unit also participated in a Study conducted by the Federal Water Pollution Control Administration's Methods and Performance-Evaluation Analytical Quality Control Laboratory also based in Cincinnati, Ohio.

The Study was: FWPCA Method Study 3 Demand Analyses. Analyses requested were Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). Also included was Total Organic Carbon (TOC) for which we were not equipped.

PERSONNEL ENRICHMENT ACTIVITIES

All staff members of the Chemistry Unit participated to some degree in activities calculated to improve them professionally.

Activities Included.

Training Course for a Water Chemist III in Gas Chromatography at the Taft Center, Cincinnati, Ohio

Division Inservice Training Program--the entire staff attended 8 half-day sessions. Chemistry Lab staff made presentations at three of the sessions

College continuation courses sponsored by the Civil Service Commission were attended by some Chemistry Personnel

Lake Michigan Water Analysts quarterly meetings were attended by several of the Chemists and Laboratory Technicians

Great Lakes Research International--5 Chemists attended at Milwaukee for a one-day symposium

(WPL) TABLE-2

CHEMICAL ANALYSIS OF NORTH AND CENTRAL WATER DISTRICTS 1969

	RAW	OUTLET		PUMPING STATIONS	
SAMPLING POINT	SHORE	NORTH	CENTRAL	MAYFAIR	CENTRAL PK
TEMPERATURE, °F *	56	55.1	55.2	55.4	55.1
TURBIDITY *	7	0.2	0.3	0.2	0.2
ODOR, STRAIGHT *	3DsM	2Cc	3Cc	4Cc	3Cc
ODOR, DECHLORINATED *	-	IM	IM	IM	IM
COLOR *	2.2	0	0	0	0
pH *	8.32	8.09	8.07	8.08	8.13
ALKALINITY, PHENOLPHTHALEIN	0.5	0	0	0	0
ALKALINITY, TOTAL	109	105.6	105	106	108
CARBON DIOXIDE, FREE	0	0.83	0.80	0.51	0.50
OXYGEN, DISSOLVED	10.5	11.4	8.6	11.2	11.2
OXYGEN DEMAND (COD)	10.8	3.31	2.53	5.66	3.52
NITROGEN, AMMONIA	0.07	0.07	0.07	0.05	0.05
NITROGEN, ORGANIC	0.47	0.19	0.17	0.23	0.17
NITROGEN, NITRATE	0.08	0.09	0.09	0.06	0.09
NITROGEN, NITRITE	0.005	ND	0.001	0.002	0.002
PHENOL	0.001	0.003	0.002	0.003	0.003
DETERGENT (MBAS)	ND	ND	ND	ND	ND
RESIDUE, FILTERABLE	152	162	159	157	160
RESIDUE, TOTAL	178	173	178	172	169
RESIDUE, TOTAL FIXED	75	82	92	70	67
SILICA (SiO_2)	2.7	1.8	1.6	2.1	1.6
METAL OXIDES (R_2O_3)	1.7	1.5	1.6	1.8	1.4
SULFATE (SO_4)	24.5	28.4	30.0	29.3	27.9
PHOSPHATE (PO_4)	0.04	0.02	0.03	0.03	0.02
ALUMINUM	0.03	0.13	0.14	0.13	0.14
ARSENIC (As)	ND	ND	ND	ND	ND
BORON (B)	ND	ND	ND	ND	ND
CADMIUM (Cd)	ND	ND	ND	ND	ND
CHROMIUM (VI) (Cr)	ND	ND	ND	ND	ND
CHROMIUM, TOTAL (Cr)	0.009	0.004	0.002	0.003	ND
COPPER (Cu)	0.006	0.003	0.003	0.002	0.002
IRON, SOLUBLE (Fe)	0.03	0.02	0.01	0.02	0.02
LEAD (Pb)	0.005	0.002	0.003	0.005	0.005
MANGANESE (Mn)	0.004	0.003	0.002	0.003	0.002
NICKEL (Ni)	0.004	0.007	0.007	0.006	0.007
COBALT (Co)	0.0040	0.0032	0.0047	0.0025	0.001
ZINC (Zn)	0.009	0.005	0.004	0.004	0.004
CALCIUM (Ca)	38	40	39	39	40
LITHIUM (Li)	0.003	0.003	0.003	0.003	0.004
STRONTIUM (Sr)	0.084	0.0479	0.074	0.087	0.0815
MAGNESIUM (Mg)	10	9	10	11	10
POTASSIUM (K)	1.6	1.6	1.3	1.4	1.4
SODIUM (Na)	4.6	5.3	5.6	5.4	5.6
RADIOACTIVITY, pc/L *	3.8±1.5	2.0±1.5	2.1±1.5	2.9±1.5	2.1±1.5
CONDUCTANCE mhos/cc *	262	281	257	269	276
RESISTANCE ohms/cc *	3933	3660	3677	3793	3713
CHLORIDE (Cl)	6.9	9.8	9.4	9.2	8.9
CYANIDE (CN)	ND	ND	ND	ND	ND
FLUORIDE (F)	0.16	1.00	1.02	0.98	1.01
BICARBONATE as $CaCO_3$	106.8	104.9	103.9	105.2	102.4
CARBONATE as $CaCO_3$	2.49	1.46	1.39	1.47	1.60
HARDNESS as $CaCO_3$	134	141	141	139	138
LANGELIER STABILITY INDEX	+0.25	+0.02	-0.03	-0.02	+0.02

* ALL OTHER VALUES ARE IN PPM

COMPOSITE OF APRIL, JUNE, SEPTEMBER & DECEMBER SEASONALS FOR 1969

WATER PURIFICATION DIVISION

(WPL) TABLE-3

CHEMICAL ANALYSIS OF SOUTH WATER DISTRICT
1969

		OUTLET		PUMPING STATIONS	
SAMPLING POINT	RAW HDR.	73rd. ST.	79th ST.	ROSELAND	WESTERN
TEMPERATURE, °F *	55.9	57.3	56.9	55.7	55.5
TURBIDITY *	6	0.15	0.15	0.15	0.15
ODOR, STRAIGHT *	4DsM	2C	2C	2Cm	3Cm
ODOR, DECHLORINATED *	- - -	1M	1M	1M	1M
COLOR *	2	0	0	0	0
pH *	8.32	7.98	8.00	8.08	8.01
ALKALINITY, PHENOLPHTHALEIN	0.5	0	0	0	0
ALKALINITY, TOTAL	109	103.2	104.2	105.2	104.7
CARBON DIOXIDE, FREE	0	0.80	0.73	0.53	0.58
OXYGEN, DISSOLVED	10.6	10.8	10.8	11.0	11.4
OXYGEN DEMAND (COD)	10	7.14	4.1	5.49	7.58
NITROGEN, AMMONIA	0.06	0.20	0.23	0.22	0.22
NITROGEN, ORGANIC	0.37	0.20	0.24	0.25	0.27
NITROGEN, NITRATE	0.13	0.10	0.08	0.07	0.07
NITROGEN, NITRITE	0.009	ND	ND	ND	ND
PHENOL	ND	0.001	0.001	0.001	0.002
DETERGENT (MBAS)	ND	ND	ND	ND	ND
RESIDUE, FILTERABLE	159	162.2	166.2	165.2	162.7
RESIDUE, TOTAL	179	171	177.5	180	171.5
RESIDUE, TOTAL FIXED	77.7	68	67.5	81	76.2
SILICA (SiO_2)	2.4	1.9	2.3	2.1	2.0
METAL OXIDES (R_2O_3)	2.1	2.0	1.7	2.5	1.5
SULFATE (SO_4)	24.1	28.4	28.8	28.2	28.6
PHOSPHATE (PO_4)	0.05	0.03	0.01	0.01	0.01
ALUMINUM	0.04	0.09	0.07	0.06	0.09
ARSENIC (As)	ND	ND	ND	ND	ND
BORON (B)	ND	ND	ND	ND	ND
CADMIUM (Cd)	ND	ND	ND	ND	ND
CHROMIUM (VI) (Cr)	0.001	ND	ND	ND	ND
CHROMIUM, TOTAL (Cr)	0.011	0.003	0.003	0.002	0.004
COPPER (Cu)	0.010	0.004	0.003	0.003	0.004
IRON, SOLUBLE (Fe)	0.02	0.02	0.01	0.02	0.02
LEAD (Pb)	0.003	0.002	0.004	0.004	0.001
MANGANESE (Mn)	0.004	0.002	0.002	0.002	0.002
NICKEL (Ni)	0.005	0.005	0.007	0.006	0.008
COBALT (Co)	0.001	0.001	0.001	0.001	0.0005
ZINC (Zn)	0.032	0.003	0.003	0.005	0.004
CALCIUM (Ca)	37	37	35	39	40
LITHIUM (Li)	0.003	0.002	0.003	0.003	0.004
STRONTIUM (Sr)	0.065	0.069	0.069	0.066	0.089
MAGNESIUM (Mg)	8.7	10.5	10.7	9.5	9.2
POTASSIUM (K)	1.7	1.8	1.7	1.3	1.4
SODIUM (Na)	4.9	4.7	4.8	4.8	4.8
RADIOACTIVITY, pc/L *	5.1±1.5	2.4±1.5	2.6±1.5	2.2±1.5	3.2±1.5
CONDUCTANCE mhos/cc *	263.7	277	273	266	270
RESISTANCE ohms/cc *	3610	3710	3683	3850	3760
CHLORIDE (Cl)	7.1	9.0	8.9	8.9	9.2
CYANIDE (CN)	ND	ND	ND	ND	ND
FLUORIDE (F)	0.18	0.98	0.99	1.00	0.99
BICARBONATE as $CaCO_3$	106.3	102.2	103.4	103.7	103.7
CARBONATE as $CaCO_3$	2.77	1.16	1.18	1.42	1.20
HARDNESS as $CaCO_3$	128.7	135.7	136.5	135.7	138.5
LANGELIER STABILITY INDEX	+0.21	-0.10	-0.09	-0.02	-0.03

* ALL OTHER VALUES ARE IN PPM

COMPOSITE OF APRIL, JUNE, SEPTEMBER & DECEMBER SEASONALS FOR 1969

WATER PURIFICATION DIVISION

WATER QUALITY SURVEILLANCE SECTION

Jack W. Steiner
Sanitary Engineer V

The Water Quality Surveillance Section maintains surveillance of all water furnished by the two filtration plants, makes sanitary surveys of Lake Michigan, the areas surrounding the water intakes and rivers and harbors, the water tunnels and shafts, and the pumping stations and distribution system. In addition, many diversified activities are undertaken by the Section to safeguard the water against adverse quality conditions. Meteorological and hydraulic data are collected and correlated, the sterilization of water mains is supervised, lake front inspections are performed and water quality complaints are investigated.

A fleet of eight automobiles is maintained by the Section to perform the field work involved in these operations. Portable chlorine gas rotameters, solution type chlorination units, and three field radio communication units installed in automobiles are maintained and kept in working order. All of this equipment is ready and available on a 24 hour basis. This includes consumer and disaster emergencies when the Section is called upon to provide equipment and technical assistance.

WATER QUALITY SURVEILLANCE

A part of water quality surveillance is the collection of water samples for laboratory examination and the sanitary evaluation of the results. During 1969, there were 30,792 water samples collected by the Section. These were submitted to the laboratories for bacteriological, chemical, taste, odor, plankton and other physical determinations. Of this total 12,907 samples of treated water were collected at the eleven pumping stations supplied by the Central and South Water Filtration Plants and at certain designated sampling points in the distribution system. Treated water samples collected in the distribution system supplied by the Central Water Filtration Plant had an average free chlorine residual of 0.51 parts per million (ppm) and a coliform average of 0.034 organisms per 100 milliliters.

Treated water samples collected in the distribution system supplied by the South Water Filtration Plant had an average combined chlorine residual of 0.53ppm and a coliform average of 0.042 organisms per 100 milliliters.

The laboratory analyses of the treated water samples collected daily at the pumping stations and throughout the distribution system indicate that the public treated water supply was of a safe sanitary quality, and was of far better bacteriological quality than that of the USPHS recommended minimum sanitary requirements for a safe water. (See Tables 1, 2, 3)

Chlorine Residual Recorders are maintained and serviced at 13 locations in the pumping stations and selected points in the distribution system. These units are reconditioned when necessary and are adjusted and recalibrated on a routine basis. These units continuously monitor the treated water as it leaves the pumping stations and flows to various parts of the distribution system to insure that an adequate chlorine residual is present in the water supply at all times.

A chlorine residual recorder was installed to monitor the water supplied by the Western Avenue Reservoir during the summer months. This was an aid in controlling operations at the Western Avenue Pumping Station when the reservoir was being used. The Western Avenue Reservoir was placed in service for the summer season on May 29 under the supervision of a Water Quality Surveillance Section Sanitary Engineer after necessary sanitary precautions and sampling to insure safe water quality.

Washington Park Pumping Station was placed in service for the summer season on June 13 after first pumping to waste the stale water in the station's tunnel and wet well. Bacterial samples were collected and analyzed daily to insure safe water quality, and a supplementary chlorine treatment of 4 pounds per million gallons was maintained while the station was in service. This operation was supervised by Water Quality Surveillance Section engineers. A daily chlorine treatment log was kept by pumping station personnel.

WATER POLLUTION SURVEYS

Water Quality Surveillance of the lake included 5 North Shore and 5 South Shore lake surveys, weekly sampling of the Calumet Industrial area and Mouth of the Chicago River area, radial surveys in the vicinity of the Central and South Water Filtration Plant intakes and 4 land surveys of water treatment plants along the shoreline. The small boat harbor surveys were continued during the boating season. In addition, special pollution surveys were conducted on April 6 pertaining to an oil spill in the area of the Indiana Harbor Ship Canal and again on August 28 and November 21 when oil spills were sighted near the Central Water Filtration Plant intakes.

A special pollution investigation was made in September around Navy Pier and the Ogden Slip in collaboration with the Bureau of Sewers to determine the cause of abnormally high coliform and fecal coliform counts found in the area. A sewer that might cause surcharging during heavy rains was cleaned; however, no active sources of pollution from sewer outfalls or overflows were found. It was concluded that the most probable cause of the high counts was discharge of sewage from large vessels docked at the Pier. In August, an investigation of a sewage discharge from a cargo vessel docked at Navy Pier resulted in court action and a fine for discharging raw sewage at the Pier.

A summary of the water quality surveys of 1969 from the tributaries, harbors, and lake water in the Chicago vicinity indicates increases in bacteriological parameters. Some of these increases can only be a result of untreated human waste contamination.

Ammonia Nitrogen and Phosphates, which provide nutrients for plankton and other organisms, again exceeded recommended criteria at most sampling points. Until there is some reduction in these parameters taste and odor problems will continue and the cost of treatment will increase.

Industrial pollution in the form of phenols took some sharp increases along the north shore off Waukegan and North Chicago and in open waters between Burns Ditch and Gary. The average data from these areas exceeded recommended water quality standards. Results of the tests for detergents showed

improvement in 1969 and it would appear that the new biodegradable detergents are aiding in the reduction of this pollutant.

Results from the Small Boat Harbor Surveys would indicate that the ordinance prohibiting pollution of the harbors is not being enforced in as much as the parameters tested, showed an increase in pollution during 1969.

Distribution surveys were made after large main breaks or pump failures and monthly perimeter sampling and surveys were continued. The perimeter surveys help show water stability and the continued adequacy of the chlorine and flucride treatment in the water when it reaches the outer limits of the distribution system. (See tables 7, 8, 9, 10)

SANITARY INVESTIGATIONS AND CONTROL

Daily collections of raw water samples at the crib intakes totalled 1,396 samples. Bacteriological analyses of these samples were made by the Chicago Board of Health water laboratory. Waste water from bathing and dish washing operations at the cribs is treated for settling purposes and heavily chlorinated before discharge. A total of 94 treated waste water samples were analyzed and were all found to be bacteriologically negative. An inspection of the Water Intake Cribs, made in December by Section engineers, showed that operations were being conducted in a safe and sanitary manner and that the facilities are being well maintained.

There were 194 consumer and industrial complaints handled during the year. Of these, 73 were field investigated.

One of the most interesting occurred in late November when a large loop department store reported a "sour taste" in the drinking water. Upon investigation it was found that 4,200 gallons of ethylene glycol "anti-freeze" had been pumped into the building's cooling system, and through a cross connection some had entered the building's drinking water supply. (It was necessary to operate this air conditioning equipment throughout the winter because of a large computer installation on the fourth floor of the building.) In cooperation with the Chicago Board of Health, the City Water Distribution Division's plumbing inspectors, the Water Purification Division's Laboratory and the Department Store's building engineers, the water contaminant was identified. The cross connection was discovered and broken and the building's domestic water system was thoroughly flushed and sampled. After obtaining assurance from laboratory analyses that the drinking water no longer contained ethylene glycol, the building's domestic drinking water facilities were again made available for service.

Water quality checks of 32 Chicago Housing Authority Projects were made during the year and 250 bacteriological samples were collected and analyzed to insure sanitary water quality in the new housing projects.

A total of 116,052 feet of water main was chlorinated and sampled. This involved the disinfection of 137 water mains varying in size from 8 inches(in.) to 54 in. in diameter.

In addition, 30 seepage investigations were made in an effort to determine

the source, type and point of entrance of seepage. These investigations were made in City of Chicago pumping stations, shafts and tunnels as well as in private industrial and domestic establishments when requested.

All 4-11 fires or larger were covered on a 24 hour basis and chlorine residuals and bacteriological samples were taken in the area around the fire to assure that no pollutants had been drawn into the mains. A total of 64 large main breaks and shut downs were investigated to be certain that appropriate sanitary procedures were followed. The roof tanks of 25 buildings were sampled and 18 hose sterilizations and special sterilization services were provided.

A special survey of the loading dock facilities, storage tanks and hose connections for supplying drinking water to cargo vessels was made. The methods for making temporary hose connections were studied and recommendations were made for rewriting the City sewer construction specifications on this subject.

The Section made numerous inspections and samplings of the harbors, rivers and selected points along the lakefront on a weekly basis in addition to surveillance of any dumping operations.

PUMPING STATIONS, SHAFTS AND TUNNELS

The chlorine solution hoses and conduits along with the supporting structures were removed from the shafts at Central Park, Cermak, Chicago Avenue, Thomas Jefferson and Mayfair Pumping stations during the year. Sanitizing procedures were followed under the direction of Section Sanitary Engineers during these operations. Chicago Avenue pumping station shafts J, K, L and M were partially dewatered in preparation for capping and sealing. These shafts were inspected and recommendations were made for repair. During the extensive modifications on the shafts at Chicago Avenue pumping station numerous inspections were made by Section engineers and necessary sanitary procedures were followed to safeguard water quality.

Construction of new shaft and tunnel connections at Springfield Avenue pumping station and the removal of the old wet well required the presence of a Section Sanitary Engineer on numerous occasions especially when a diver was working in the tunnels or shafts. This work was carried out without shutting down the pumping station and required sanitizing the diver and all equipment to safeguard water quality during operations.

Disinfection, flushing and sampling of the new shaft and tunnel connections at Springfield Avenue pumping station were performed by Section engineers during the first week in May after the shaft had been dewatered and inspected.

The construction of the Mayfair Pressure Tunnel required the supervision of a Section engineer on numerous occasions to sanitize and disinfect connections, valves and other appurtenances. The tunnel was disinfected, flushed and sampled by Section engineers during the first week of August.

An inspection of the new tunnel connection between the Central Water Filtration

Plant and the Dever tunnel was made by Section engineers on November 4 along with other engineers of the Bureau of Water. Photographs were taken of significant areas observed during the tunnel inspection and seepage samples were obtained of flows near the Chicago Avenue shore shaft and sluice gate. A special report was prepared covering this inspection.

The Lawrence Avenue tunnel construction for handling storm water run-off required the installation of monitoring wells to observe any possible infiltration of the underground formations in the area surrounding the tunnel. Recommendations for the locations and construction of these monitoring wells were made by the Section engineers and a program for sampling the wells was planned.

SUBURBS

Field inspections were made at 54 suburban communities during the year. New construction at Blue Island, Cicero, Crestwood, Forest Park, Hickory Hills, Hillside, Hodgkins, Maywood, Palos Hills, Palos Heights, Park Ridge, South Stickney Sanitary District and Worth was in progress or had been recently completed. These new improvements increase capacity of existing utilities to take care of population growth, provide new facilities in some communities formerly supplied by wells and provide improved supplementary chlorination treatment. Overall operation and maintenance was good in most of the suburbs inspected in spite of their difficulty in obtaining personnel. Sanitary and operational deficiencies were noted in a few suburbs and these were pointed out to waterworks officials.

Plans for waterworks improvements were reviewed for Burnham, Hillside-Berkeley Water Commission, Hickory Hills, Hodgkins, Maywood and Schiller Park. Sanitary approval was given after recommended revisions were incorporated in the plans and specifications. There were 816 bacterial reports on samples collected on a monthly basis by the suburbs and submitted to State and County health authorities for analysis. These were reviewed by the Section as well as samples collected on field inspection trips. An analysis of the bacteriological reports show that water of a safe and sanitary quality is being supplied to suburban consumers of Chicago processed Lake Michigan water.

METEOROLOGICAL AND HYDRAULIC

Rain gauges were maintained at Mayfair, Springfield Avenue and Roseland pumping stations as well as at the South and Central Water Filtration Plants. The maintenance of equipment and collection of precipitation data at the Central Water Filtration Plant was assumed by the Section on June 1, 1969. All of the older weather stations have been modernized and the older type of recording equipment has been replaced with up to date equipment. New copper snow cans for measuring snowfall have replaced the older cans.

The rain gauges measured an average precipitation of 29.98 in. for the year. This figure was 3.20 in. below normal for the City as recorded by our gauges. The U.S. Weather Bureau's rain gauge at Midway Airport recorded a yearly total of 36.78 in. (See Table 5).

A tabulation of lake water temperature, and of wind movement as recorded at the

Central Water Filtration Plant is shown in Tables 4 and 6. The average wind velocity was 8.7 miles per hour in a prevailing Southwesterly direction. The average lake level elevation as recorded at the Central Water Filtration Plant was 1.2 feet above Chicago City Datum. (See Figure 1)

MISCELLANEOUS

Each year many individuals and companies call the Section for information about the Chicago water system. This year 46 such inquiries were made and department publications were sent when requested.

The Board of Health reported 8 typhoid fever cases, with no deaths and 96 amoebic dysentery cases, with 1 death. None of these cases was attributable to the Chicago water supply.

TABLE-1

SUMMARY OF AVERAGE RESIDUAL CHLORINE IN WATER LEAVING PUMPING STATIONS

1969

MONTH	SOUTH DISTRICT					CENTRAL DISTRICT					NORTH DISTRICT			
	68 ST.	WESTERN	ROSE-LAND	SOUTH-WEST	SYSTEM	SPRING-FIELD	CENTRAL PARK	CHICAGO AVE.	CERMAK	SYSTEM	MAYFAIR	JEFFER-SON	LAKE-VIEW X	SYSTEM
JANUARY	0.70	0.58	0.66	0.64	0.63	0.62	0.66	0.65	0.75	0.66	0.60	0.60	–	0.60
FEBRUARY	0.71	0.59	0.70	0.66	0.66	0.60	0.61	0.62	0.75	0.64	0.56	0.59	–	0.57
MARCH	0.71	0.61	0.70	0.65	0.66	0.61	0.64	0.64	0.74	0.65	0.56	0.61	–	0.58
APRIL	0.79	0.68	0.78	0.71	0.72	0.60	0.62	0.63	0.70	0.62	0.56	0.59	–	0.58
MAY	0.72	0.61	0.69	0.65	0.66	0.57	0.58	0.61	0.71	0.60	0.54	0.55	0.52	0.53
JUNE	0.69	0.57	0.68	0.59	0.63	0.69	0.70	0.75	0.80	0.73	0.63	0.69	0.62	0.64
JULY	0.80	0.70	0.80	0.74	0.76	0.60	0.64	0.69	0.75	0.66	0.57	0.62	0.60	0.59
AUGUST	0.84	0.69	0.80	0.78	0.77	0.59	0.60	0.64	0.70	0.63	0.55	0.59	0.61	0.57
SEPTEMBER	0.73	0.62	0.69	0.67	0.67	0.65	0.66	0.67	0.71	0.67	0.57	0.62	0.57	0.58
OCTOBER	0.78	0.66	0.74	0.71	0.70	0.61	0.64	0.64	0.78	0.66	0.55	0.59	0.61	0.57
NOVEMBER	0.67	0.60	0.64	0.63	0.63	0.66	0.69	0.68	0.79	0.69	0.57	0.61	0.61	0.59
DECEMBER	0.63	0.57	0.60	0.59	0.59	0.65	0.71	0.68	0.80	0.71	0.60	0.64	0.65	0.62
YEAR	0.73	0.62	0.70	0.66	0.67	0.61	0.64	0.66	0.75	0.66	0.56	0.61	0.60	0.58

EXPRESSED AS PARTS PER MILLION.

X SAMPLING COMMENCED MAY 1 st.

WATER PURIFICATION DIVISION

TABLE-2

SUMMARY OF BACTERIAL ANALYSES OF WATER LEAVING PUMPING STATIONS 1969

STATION	NUMBER OF SAMPLES	AVERAGE BACTERIA 35° 24HR. PER ml.	AVERAGE COLIFORM ORGANISMS PER 100ml (MEMBRANE FILTER)
MAYFAIR	868	0	0.016
JEFFERSON	464	0	0.000
LAKEVIEW X	265	0	0.004
SPRINGFIELD	778	0	0.001
CENTRAL PARK	740	0	0.036
CHICAGO AVENUE	591	0	0.030
CERMAK	506	0	0.000
NORTH & CENTRAL WATER DISTRICTS	4,212	0	0.014
68 th ST.	559	0	0.005
WESTERN AVENUE	672	0	0.019
ROSELAND	728	0	0.001
SOUTHWEST	613	0	0.001
SOUTH WATER DISTRICT	2,572	0	0.007
TOTAL SYSTEM	6,784	0	0.011

X SAMPLING COMMENCED MAY 1st.

TABLE-3

SUMMARY OF BACTERIAL ANALYSES OF WATER IN DISTRIBUTION SYSTEM 1969

STATION	NUMBER OF SAMPLES	PPM CL_2 RESIDUAL AT SAMPLING POINT	AVERAGE BACTERIA 35° 24 HR. PER ml.	AVERAGE COLIFORM ORGANISMS PER 100 ml. (MEMBRANE FILTER)
MAYFAIR	598	0.48	2	0.005
JEFFERSON	448	0.48	0	0.002
LAKEVIEW	452	0.49	0	0.029
SPRINGFIELD	609	0.50	0	0.034
CENTRAL PARK	443	0.49	0	0.033
CHICAGO AVE.	506	0.55	0	0.006
CERMAK	896	0.55	0	0.087
NORTH & CENTRAL WATER DISTRICTS.	3,952	0.51	0	0.034
SOUTH WATER DISTRICT				
68th ST.	562	0.54	0	0.012
WESTERN AVE.	584	0.51	0	0.043
ROSELAND	727	0.54	0	0.117
SOUTHWEST	298	0.52	0	0.017
SYSTEM	2,171	0.53	0	0.056
TOTAL CHICAGO SYSTEM	6,123	0.52	0	0.042

TABLE-4

SUMMARY OF DAILY WATER TEMPERATURES
OBSERVED AT THE
CENTRAL WATER FILTRATION PLANT 1968-1969
(TEMPERATURES IN °F)

YEAR	JAN.			FEB.			MARCH			APRIL			MAY			JUNE			JULY			AUG.			SEPT.			OCT.			NOV.			DEC.			ANNUAL			
	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	
1968	35	32	33.2	35	32	32.5	45	32	36.2	51	43	47.0	58	51	54.1	66	55	60.1	73	60	66.7	72	55	65.5	67	55	60.8	60	52	55.2	50	38	42.9	39	32	33.6	73	32	49.0	1968
1969	33	32	32.0	33	32	32.8	36	32	33.2	48	35	42.7	56	47	51.3	67	52	57.6	76	60	68.2	75	67	70.6	73	59	66.0	65	48	57.2	48	37	43.3	37	32	34.3	76	32	49.2	1969
1968 1969	35	32	32.1	35	32	33.2	45	32	34.7	51	43	44.8	58	51	52.7	67	55	58.9	76	60	67.4	75	67	68.0	73	59	63.4	65	52	56.2	50	38	43.0	39	32	34.0	76	32	49.2	1968 1969

WATER PURIFICATION DIVISION

(SHEET 1 OF 2)

TABLE - 5

PRECIPITATION IN CHICAGO

EXPRESSED IN INCHES

1969

	JANUARY					FEBRUARY					MARCH					APRIL					MAY					JUNE				
	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF
1																0.55	0.60	0.68	0.63							0.41	0.68	0.20	0.14	0.33
2																0.09	0.08	0.17	0.17							0.07	0.10			
3																														
4																0.83	0.89	1.37	1.35							0.71	1.12	0.07	0.07	0.71
5	0.03	0.06	0.01																											
6		0.06	0.14	0.03				0.22	0.08					0.06							0.27	0.20	0.25	0.26		0.32	0.41	0.30	0.29	0.31
7	0.09					0.05	0.08														0.21	0.21	0.28	0.22		0.74	0.92	0.50	0.54	0.74
8																					0.58	0.52	0.54	0.60		1.57	1.22	0.56	0.60	1.20
9																0.56	0.43	0.46	0.41		0.21	0.25	0.21	0.19						0.02
10																					0.44	0.40	0.38	0.48					0.01	
11																										0.04	0.02			0.05
12																														
13																														
14																0.47	0.75	0.78	0.81							0.03	0.04	0.04		0.03
15	0.06	0.09	0.08	0.12													0.04	0.07	0.02											
16	0.11	0.10	0.18	0.18												0.12	0.05	0.02												
17	0.27	0.27	0.35	0.42												1.26	1.11	1.08	1.19		0.62	0.36	0.48	0.58		0.40	1.00	0.50	0.33	0.72
18																0.41	0.30	0.11	0.13		0.36	0.14	0.36	0.36		0.04	0.13	0.05		0.04
19																										0.02				
20											0.03	0.12	0.13	0.17												0.03				0.04
21	0.01															0.01	0.03	0.06	0.03		0.16	0.12	0.12	0.16		0.01	0.02			0.04
22	0.07	0.03		0.02		0.03	0.08	0.02	0.03							0.01					0.17	0.13	0.13	0.17		0.84	0.58	1.47	1.08	0.66
23		0.17	0.15	0.18		0.01	0.02		0.01																	0.03	0.04	0.03	0.03	0.01
24			0.01								1.13	1.11	1.04	1.32												0.01	0.01	0.01	0.02	
25											0.09	0.16	0.25	0.31												0.16	0.32	0.14		0.03
26												0.08	0.04	0.04												0.01	0.08			0.02
27																0.26	0.39	0.20	0.18							0.15	0.10	0.14	0.09	0.14
28	0.21	0.40	0.80	0.72							0.01	0.02	0.01			0.08	0.04	0.01	0.02											
29	0.18	0.32	0.46	0.45																						0.86	0.77	0.33	0.21	0.54
30	0.01	0.01	0.03																							0.35	0.47	1.07	0.67	0.53
31																					0.39	0.36	0.41	0.40						
TOT	1.04	1.51	2.21	2.12		0.09	0.18	0.24	0.12		1.26	1.49	1.47	1.90		4.65	4.71	5.01	4.94		3.41	2.69	3.16	3.42		6.80	8.03	5.41	4.10	6.16
AVG	1.72					0.16					1.53					4.83					3.17					6.10				

WATER PURIFICATION DIVISION

(SHEET 2 OF 2)

TABLE 5 CONT'D.

PRECIPITATION IN CHICAGO

EXPRESSED IN INCHES

1969

	JULY					AUGUST					SEPTEMBER					OCTOBER					NOVEMBER					DECEMBER				
	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF	M	S	R	SF	CF
1																														
2																														
3	0.02			0.13	0.32																0.29	0.17	0.18	0.15	0.10					
4	0.05	0.18	0.18	0.01	0.22						0.31	0.26	0.24	0.27	0.26						0.03	0.03	0.04	0.02	0.08					
5	0.03	0.04	0.04	0.04	0.02						1.75	0.79	0.07	0.25	0.34															
6	0.32	0.18	0.01	0.03	0.24								0.03	0.08		0.09	0.14	0.33	0.34											
7	0.09	0.14	0.13	0.41	0.03	0.10	0.06	0.07	0.02	0.06						0.01		0.06	0.02		0.01	0.01				0.31	0.30	0.48	0.11	0.42
8	0.06	0.05	0.11	0.08	0.07																							0.04	0.02	
9			0.02		0.01	0.32	0.28	0.25	0.22	0.23																		0.03	0.03	
10									0.01							3.27	1.82	1.34	0.59											
11					0.06	0.10	0.07	0.26								0.29	0.25	0.07	0.39		0.01					0.02	0.03	0.01	0.04	0.01
12	0.09	0.30	0.17	0.02	0.09	0.01										0.58	0.83	0.43	0.40			0.01						0.48	0.15	
13			0.01													0.21	0.28		0.24											
14																			0.03											
15													0.01	0.01							0.01		0.02	0.01						
16											0.11	0.11	0.25	0.16	0.21	0.10	0.04	0.02												
17	1.58	2.64	0.85	1.85	1.96																0.43	0.48	0.16	0.14	0.31					
18	0.25	0.24	0.74	0.54	0.21																0.18	0.25	0.22	0.21	0.12					
19	0.70	1.34	1.04	0.73	0.54											0.39	0.38	0.73	0.46		0.05	0.08	0.08	0.07	0.01					
20																0.15	0.15	0.15	0.20											
21																	0.03		0.02											
22																										0.02	0.03	0.10	0.05	0.03
23											0.48	0.46	0.09	0.07	0.27											0.06	0.07	0.37	0.03	0.20
24											0.03	0.03	0.11	0.13	0.19													0.07	0.03	
25																														
26	0.88	0.86	1.41	0.75	0.52						0.10	0.09	0.01	0.03	0.07															
27	0.02	0.01	0.02	0.01	0.02						0.18	0.13	0.27	0.35	0.13															
28	0.02	0.01		0.01	0.01																					0.01	0.02	0.03	0.03	
29	0.01																													
30		0.09	0.09	0.63																										
31																0.15	0.23	0.13	0.03											
TOT	4.12	6.08	4.82	5.24	4.32	0.53	0.41	0.58	0.25	0.29	2.96	1.87	1.08	1.35	1.47	5.24	4.15	3.26	2.72		1.01	1.03	0.70	0.60	0.62	0.42	0.45	1.61	0.49	0.66
AVG			4.92					0.41					1.74					3.84					0.79					0.73		

TOTAL FOR 1969

M - MAYFAIR P.S. = 30.53"
4600 N - 4850 W

S - SPRINGFIELD AVE. P.S. = 32.60"
1750 N - 3900 W

SF - SOUTH WATER FILTRATION PLANT = 27.26"
7900 S - 3300 E

R - ROSELAND P.S. = 29.55"
10400 S - 350 W

CF - CENTRAL WATER FILTRATION PLANT = 13.52"
600 N - 1000 E

MSRSF AVG. = 29.98"

24 HR. MAX. = 2.64"

NORMAL = 33.18"

USWB AIRPORT = 36.78"

NOTE: RECORDS ON CENTRAL STANDARD TIME
ELECTRIC HEATERS USED FROM NOV. 1 TO MARCH 31, WHILE SNOW GAUGES WERE IN SERVICE.
C.W.F.P. DATA NOT INCLUDED IN AVG. THIS YEAR AS COMPLETE DATA NOT AVAILABLE. GAUGE WINTERIZED OCT. 1969.

WATER PURIFICATION DIVISION

TABLE-6

SUMMARY OF WIND MOVEMENTS BY DIRECTION & DURATION 1969

MONTH	N		NE		E		SE		S		SW		W		NW		TOTAL MILES
	MI.	HRS.	MI.	HRS.	MI.	HRS.	MI.	HRS.	MI.	HRS.	MI.	HRS.	MI.	HRS.	MI.	HRS.	
JANUARY	57	16	176	51	331	33	1266	142	933	108	364	50	3697	303	353	39	7177
FEBRUARY	635	88	2070	274	437	54	116	18	31	6	296	29	992	99	879	78	5456
MARCH	1517	134	832	94	73	9	196	25	144	23	1390	120	1564	163	1699	148	7415
APRIL	2784	202	993	131	191	28	266	50	658	98	1754	144	694	55	161	10	7501
MAY	1483	176	942	121	166	23	322	48	501	80	1286	142	896	116	276	38	5872
JUNE	1473	166	840	127	235	31	306	42	215	39	2134	207	896	96	109	12	6208
JULY	1304	189	956	163	267	40	155	35	250	52	972	131	734	110	199	24	4837
AUGUST	214	31	921	165	235	38	152	30	118	38	2181	317	604	100	149	25	4574
SEPTEMBER	985	101	1412	144	531	57	360	45	239	33	1399	165	716	103	694	72	6336
OCTOBER	223	18	836	82	700	73	498	58	307	43	2090	235	1459	168	765	67	6878
NOVEMBER	282	42	481	81	52	9	113	22	323	41	1807	189	2295	252	840	84	6193
DECEMBER	951	103	837	60	463	35	301	33	316	50	1357	153	1413	143	1277	110	6915
TOTAL MILES	11908		11296		3681		4051		4035		17030		15960		7401		75362
TOTAL HOURS		1266		1493		430		548		611		1882		1708		707	8645
% MILES	15.8		14.9		4.9		5.4		5.4		22.6		21.2		9.8		100 %
% HOURS		14.6		17.3		5.0		6.3		7.0		21.8		19.8		8.2	100 %
AVG. M.P.H.	9.4		7.6		8.6		7.4		6.6		9.0		9.3		10.5		8.7

TOTAL WIND MOVEMENT FOR YEAR - 75,362 MILES
TOTAL HOURS FOR YEAR 8,645
AVERAGE VELOCITY (M.P.H.) 8.7
AVERAGE MOVEMENT PER DAY 206.5
PREVAILING DIRECTION SW
ANEMOMETER ELEVATION 60.3

NOTE: OBSERVATIONS FROM CENTRAL WATER FILTRATION PLANT.

WATER PURIFICATION DIVISION

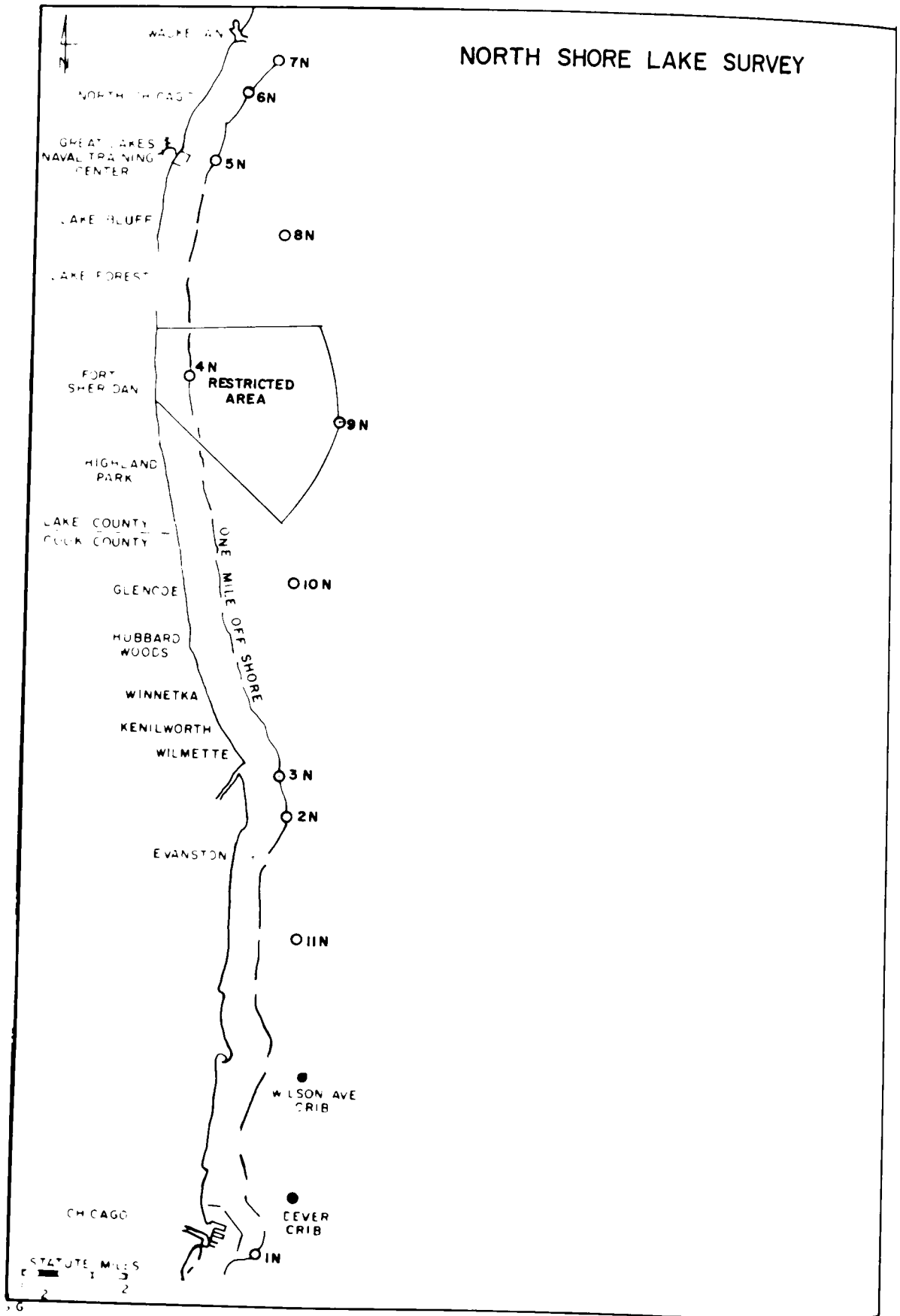

NORTH SHORE LAKE SURVEY
7N
6N
5N
8N
4N
RESTRICTED AREA
9N
10N
ONE MILE OFF SHORE
3N
2N
11N
1N
GREAT LAKES NAVAL TRAINING CENTER
LAKE BLUFF
LAKE FOREST
FORT SHERIDAN
HIGHLAND PARK
LAKE COUNTY
COOK COUNTY
GLENCOE
HUBBARD WOODS
WINNETKA
KENILWORTH
WILMETTE
EVANSTON
WILSON AVE CRIB
CHICAGO
DEVER CRIB
STATUTE MILES
WATER QUALITY SURVEILLANCE SECTION

TABLE - 7

NORTH SHORE LAKE SURVEYS
1969

CHEMICAL SUMMARY TABLE

PT. NO.	TEMP °F			pH			THRESHOLD ODOR			M.B.A.S. (ppm)			AMMONIA NITROGEN (ppm)			PHENOL (ppm)			PHOSPHATE (ppm)		
	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.
1	5	72	58	5	8.62	8.45	5	5 DsM	3	5	N.D.	N.D.	5	0.06	0.03	5	0.001	N.D.	5	0.10	0.05
2	5	71	57	5	8.70	8.45	5	6 Mm	3	5	N.D.	N.D.	5	0.05	0.03	5	N.D.	N.D.	5	0.08	0.04
3	5	71	57	5	8.70	8.46	5	4 DM	3	5	N.D.	N.D.	5	0.06	0.03	5	0.005	0.001	5	0.08	0.04
5	5	68	56	5	8.75	8.50	5	45 Df	11	5	N.D.	N.D.	5	0.08	0.03	5	0.046	0.010	5	0.07	0.04
6	5	69	56	5	8.75	8.50	5	20 Df	7	5	N.D.	N.D.	5	0.06	0.02	5	0.006	0.001	5	0.08	0.05
7	4	67	53	4	8.65	8.44	4	4 DMm	3	4	N.D.	N.D.	4	0.11	0.05	4	0.011	0.003	4	0.12	0.06
8	5	69	56	5	8.78	8.53	5	20 Df	6	5	N.D.	N.D.	5	0.06	0.03	5	0.001	N.D.	5	0.05	0.03
9	5	71	56	5	8.65	8.47	5	9 Df	4	5	N.D.	N.D.	5	0.06	0.02	5	0.003	0.001	5	0.06	0.03
10	5	70	56	5	8.70	8.50	5	10 DM	5	5	N.D.	N.D.	5	0.04	0.02	5	0.003	0.001	5	0.07	0.03
11	5	70	56	5	8.72	8.48	5	7 DM	4	5	N.D.	N.D.	5	0.05	0.02	5	0.004	0.001	5	0.05	0.02

X-NO OF TEST N.D.-NOT DETECTABLE

W.Q.S.S.

WATER PURIFICATION DIVISION

TABLE 7 CONT'D.

NORTH SHORE LAKE SURVEYS
1969

BACTERIAL SUMMARY TABLE

PT. NO.	PLATE COUNT NO/ml.			COLIFORM/100 ml. M.F.			FECAL/100 ml. (M.F.)					
							COLIFORM			STREP		
	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.
1	5	130	66	5	5600	1170	5	6	2	5	0	0
2	5	330	91	5	1600	378	5	6	2	5	0	0
3	5	210	83	5	112	50	5	2	1	5	0	0
5	5	100	55	5	290	130	5	10	2	5	4	1
6	5	120	63	5	400	126	5	4	1	5	0	0
7	4	570	191	4	560	140	4	38	10	4	4	1
8	5	33	18	5	68	23	5	0	0	5	0	0
9	5	25	10	5	128	26	5	0	0	5	0	0
10	5	35	21	5	64	23	5	4	1	5	2	0
11	5	250	86	5	1100	257	5	4	1	5	0	0

X - NO OF TEST

W.Q.S.S.

WATER PURIFICATION DIVISION

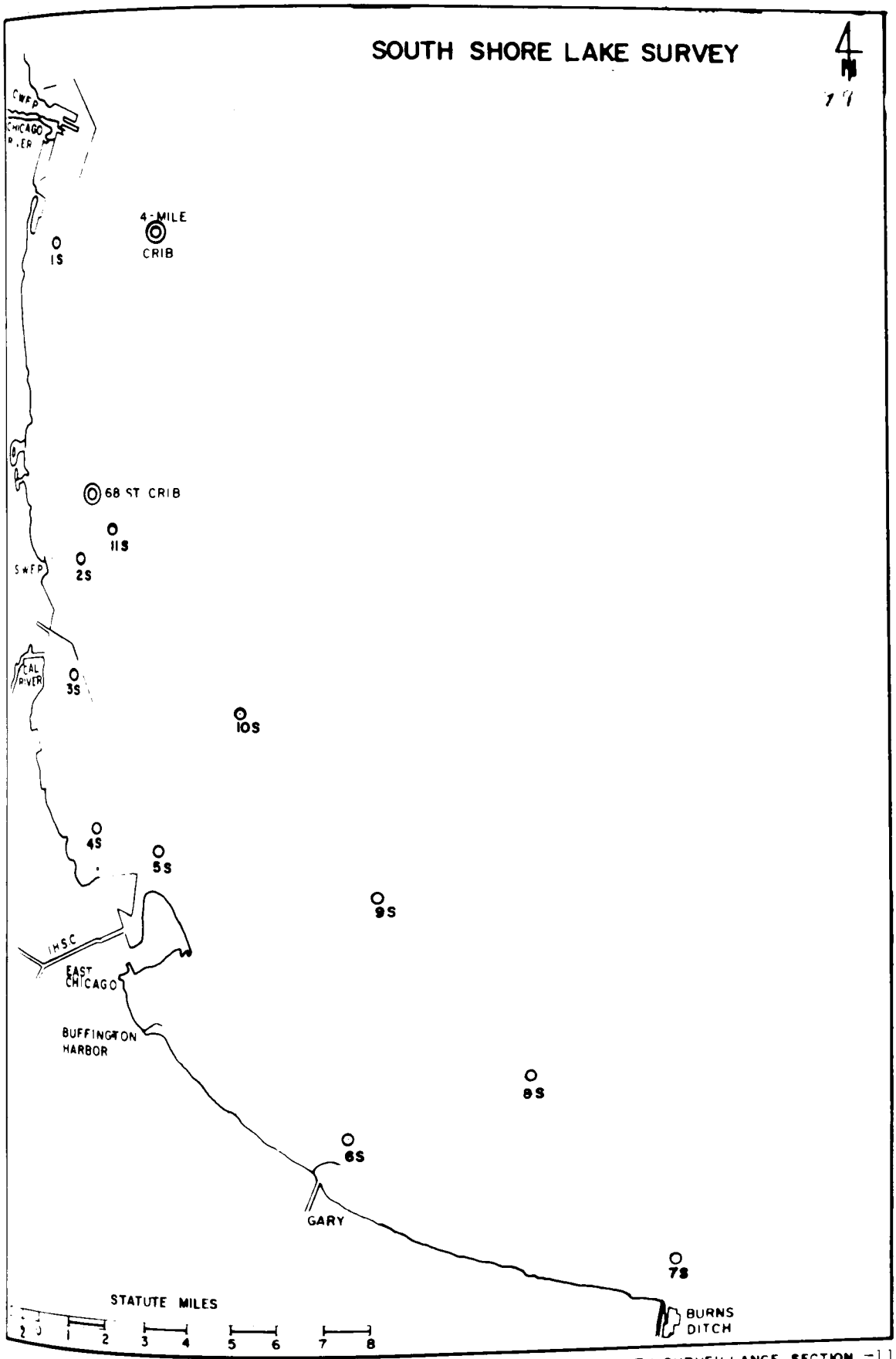

SOUTH SHORE LAKE SURVEY
4
CWFP
CHICAGO R.ER
4-MILE CRIB
1S
68 ST CRIB
11S
2S
SWFP
CAL RIVER
3S
10S
4S
5S
9S
IHSC
EAST CHICAGO
BUFFINGTON HARBOR
8S
6S
GARY
7S
BURNS DITCH
STATUTE MILES
2 1 2 3 4 5 6 7 8

TABLE-8

SOUTH SHORE LAKE SURVEYS
1969

CHEMICAL SUMMARY TABLE

PT. NO.	TEMP °F			pH			THRESHOLD ODOR			M.B.A.S. (ppm)			AMMONIA NITROGEN (ppm)			PHENOL (ppm)			PHOSPHATE (ppm)		
	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.
1	5	64	51	5	8.45	8.41	5	4 DC	3	4	N.D.	N.D.	4	0.08	0.06	5	0.003	0.001	4	0.10	0.06
2	5	66	53	5	8.50	8.45	5	4 M	3	4	N.D.	N.D.	4	0.05	0.04	5	0.003	0.001	4	0.10	0.06
3	5	66	54	5	8.48	8.38	5	4 Ch	3	4	N.D.	N.D.	4	0.15	0.09	5	0.003	0.001	4	0.11	0.07
4	5	64	53	5	8.50	8.40	5	7 Ch	3	4	N.D.	N.D.	4	0.14	0.08	5	N.D.	N.D.	4	0.12	0.07
5	5	67	56	5	8.35	8.23	5	27 Ch	11	4	0.15	0.04	4	0.30	0.24	5	0.003	0.001	4	0.19	0.10
6	4	64	55	4	8.50	8.44	4	4 Ch	3	4	N.D	N.D.	4	0.10	0.07	4	N.D.	N.D.	4	0.10	0.06
7	4	64	55	4	8.50	8.48	4	4 DM	3	4	N.D.	N.D.	4	0.12	0.06	4	N.D.	N.D.	4	0.14	0.07
8	4	65	55	4	8.52	8.47	4	7 Mm	3	4	N.D.	N.D.	4	0.05	0.03	4	0.018	0.005	4	0.07	0.03
9	4	64	54	4	8.50	8.47	4	7 Mm	3	4	N.D.	N.D.	4	0.02	0.02	4	N.D.	N.D.	4	0.07	0.03
10	5	64	53	5	8.55	8.41	5	9 Ch	4	4	0.10	0.03	4	0.06	0.02	5	0.001	N.D.	4	0.10	0.04
11	5	58	52	5	8.55	8.45	5	6 DM	3	4	N.D.	N.D.	4	0.16	0.07	5	N.D.	N.D.	4	0.09	0.04

X- NO OF TESTS N.D.- NOT DETECTABLE

W.Q.S.S.

WATER PURIFICATION DIVISION

TABLE 8 CONT'D

SOUTH SHORE LAKE SURVEYS
1969

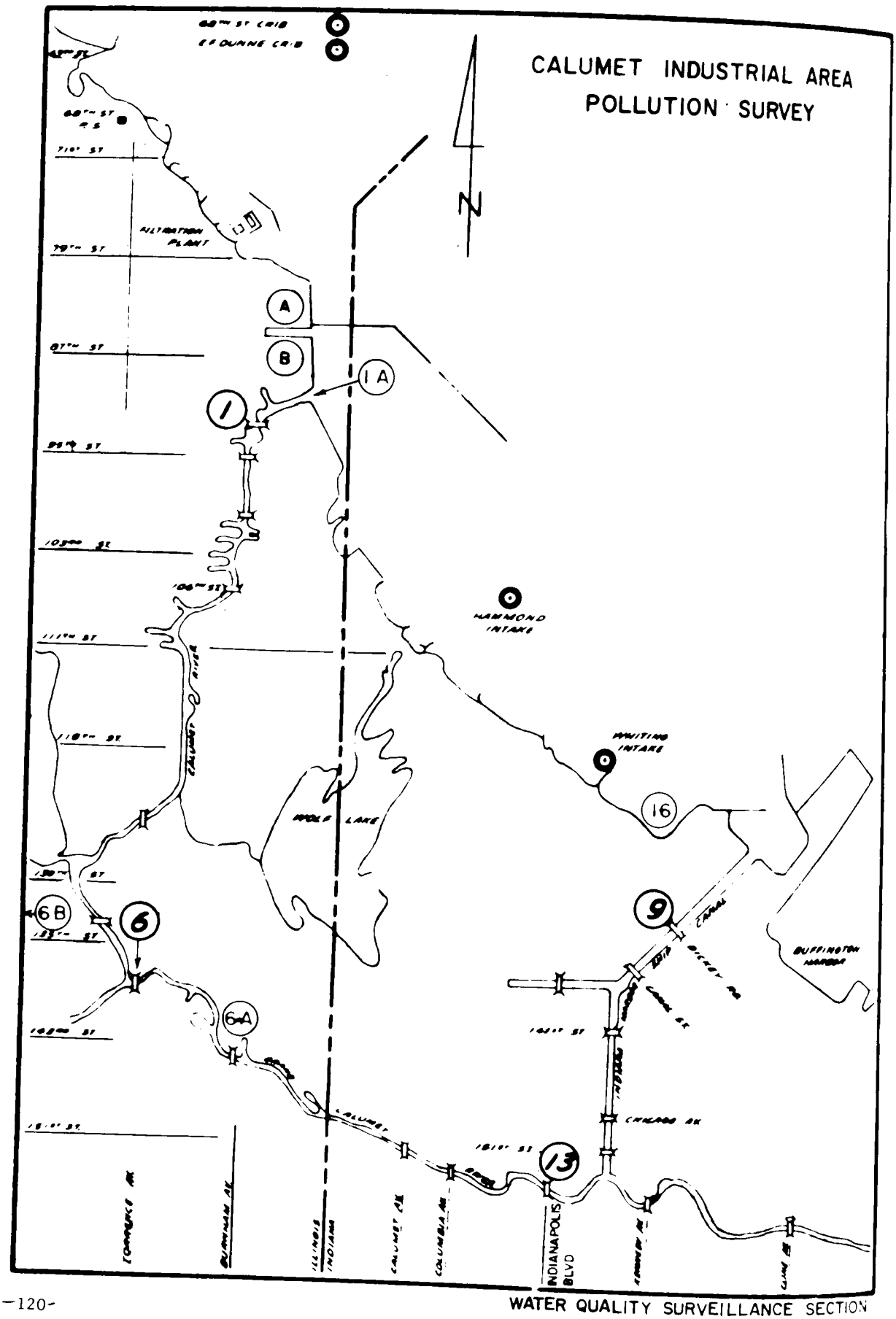
BACTERIAL SUMMARY TABLE

PT. NO.	PLATE COUNT NO/ml.			COLIFORM/100 ml. M.F.			FECAL/100 ml. (M.F.)					
							COLIFORM			STREP		
	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.	X	MAX.	AVG.
1	5	390	93	5	48	13	5	6	1	5	0	0
2	5	1,700	639	5	100	55	5	14	5	5	2	0
3	5	2,000	1,166	5	104	60	5	24	8	5	2	1
4	5	18,000	4,674	5	410	144	5	48	16	5	2	0
5	5	75,000	39,600	5	5,360	1,942	5	2,000	469	5	30	7
6	4	8,000	3,028	4	436	168	4	34	14	4	0	0
7	4	1,700	807	4	134	52	4	12	5	4	2	1
8	4	9	4	4	24	7	4	0	0	4	0	0
9	4	62	10	4	8	3	4	0	0	4	0	0
10	5	18,000	3,745	5	1,500	311	5	150	32	5	0	0
11	5	1,100	228	5	90	32	5	18	4	5	0	0

X - NO OF TESTS.

W.Q.S.S.

WATER PURIFICATION DIVISION



WATER QUALITY SURVEILLANCE SECTION

TABLE 9

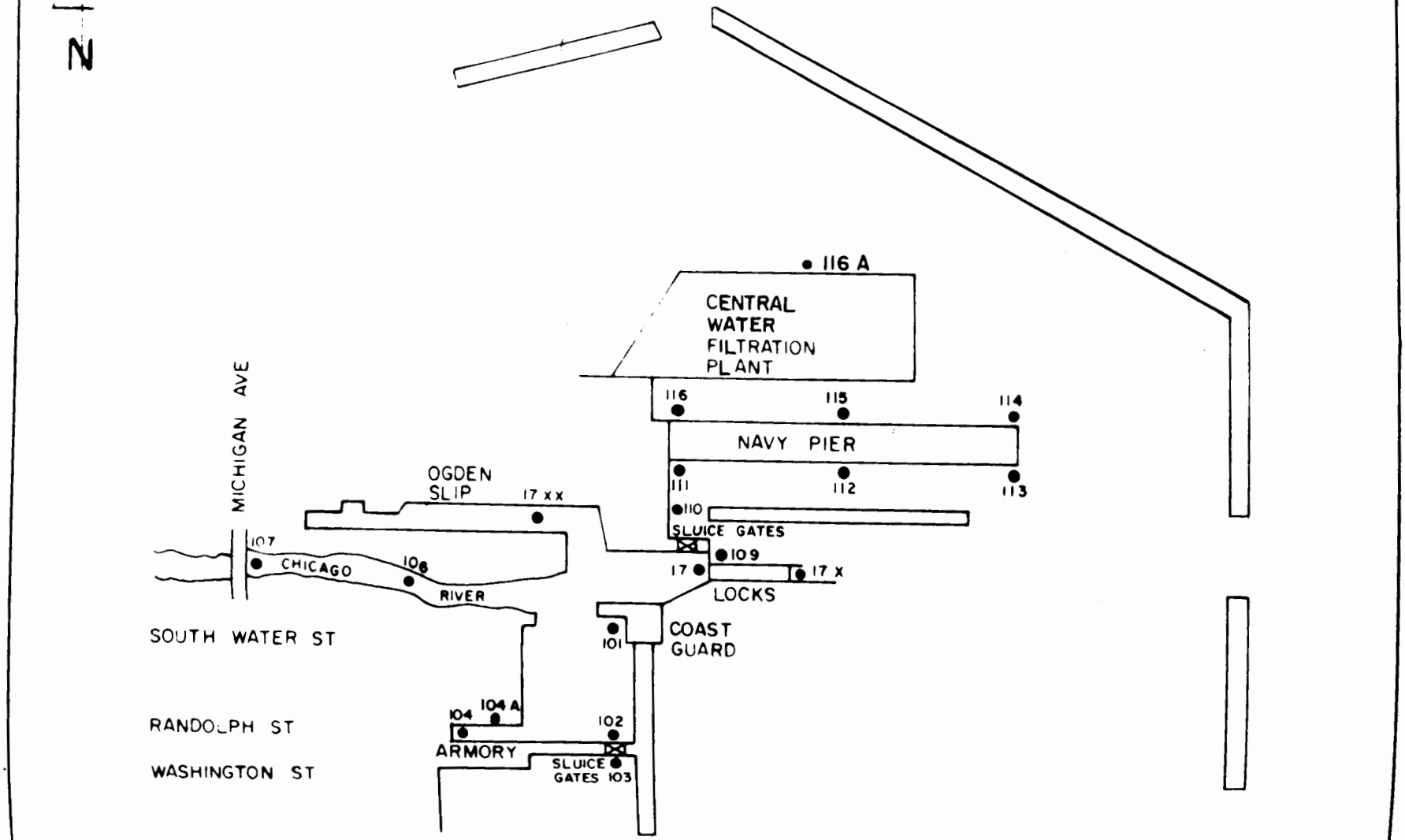
ANNUAL SUMMARY OF CALUMET INDUSTRIAL AREA POLLUTION SURVEYS
1969 *

POINT	COLI PER 100 ml.			THRESHOLD ODOR NO.			AMMONIA NITROGEN (ppm)			PHENOL (ppm)		
	MAX.	AVG.	NO. TESTS	MAX.	AVG.	NO. TESTS	MAX.	AVG.	NO. TESTS	MAX.	AVG.	NO. TESTS
A	2,400,000	485,478	51	150 Ch	25	50	2.46	0.42	51	0.012	0.002	50
B	2,400,000	65,385	51	750 DfC	26	51	2.00	0.47	51	0.013	0.001	50
1A	2,400,000	58,673	48	50 Ch	17	48	1.28	0.39	48	0.010	0.002	47
1	2,400,000	59,192	51	700 Df	24	49	13.60	0.94	50	0.013	0.001	50
6	240,000,000+	1,010,850	48	600 Cs	135	48	34.00	9.99	48	0.147	0.020	47
6A	24,000,000	6,583,922	51	500 DsC	139	50	20.00	10.40	50	0.125	0.021	49
6B	24,000,000	697,957	51	75 Ds	17	50	16.00	5.94	50	0.036	0.005	49
9	24,000,000	1,349,647	51	650 DsM	113	50	18.00	7.46	51	0.075	0.017	50
13	24,000,000+	4,770,311	51	450 A	135	51	60.00	16.54	50	0.044	0.014	49
16	240,000	13,666	42	1,000 A	179	44	5.60	0.51	43	0.049	0.006	43

* ALL PARAMETERS NOT LISTED.

WATER PURIFICATION DIVISION

POLLUTION SURVEY IN VICINITY OF MOUTH OF CHICAGO RIVER



WATER QUALITY SURVEILLANCE SECTION

TABLE 10

ANNUAL SUMMARY OF POLLUTION SURVEYS IN VICINITY OF MOUTH OF CHICAGO RIVER

1969 x

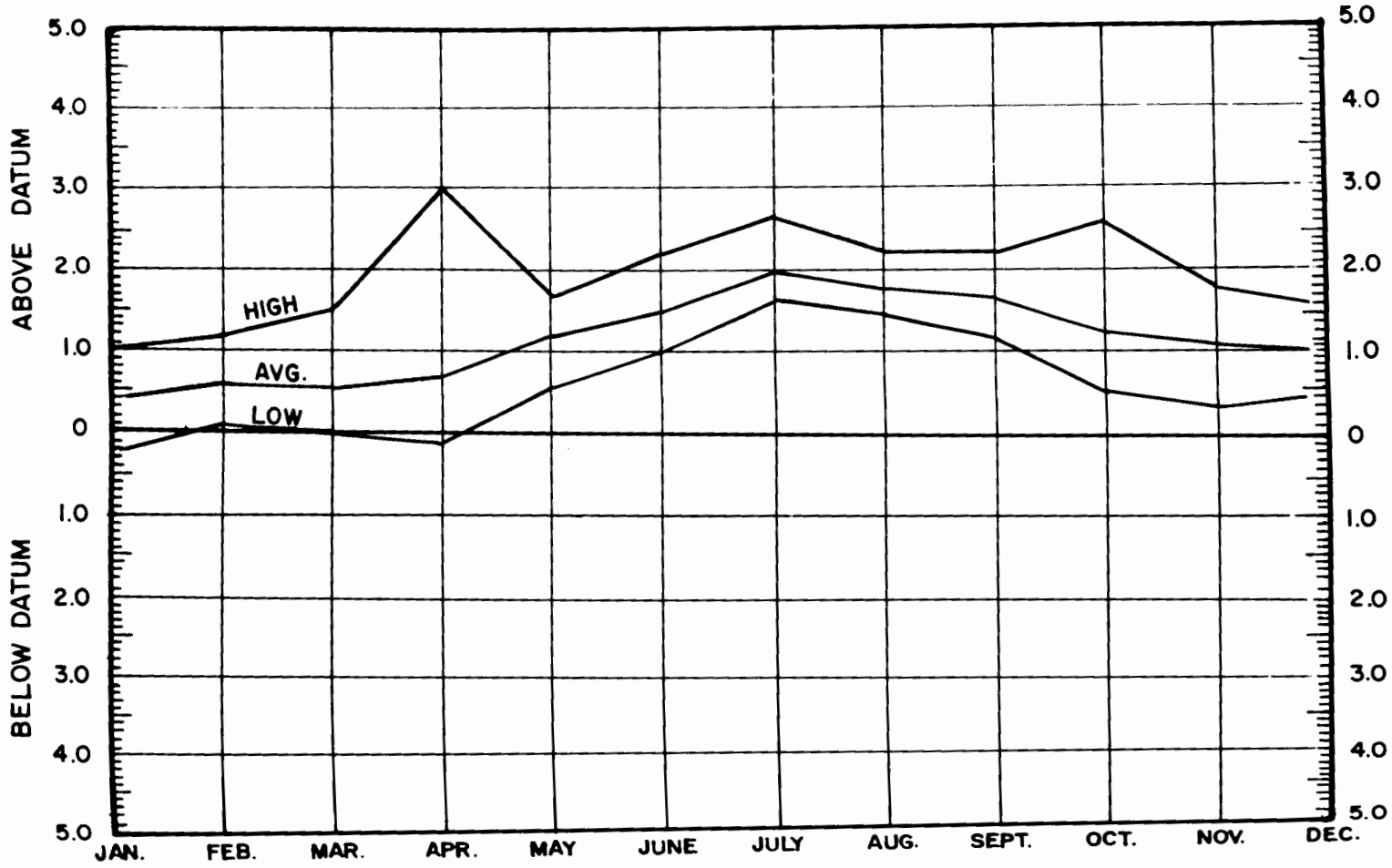
POINT	COLI PER 100 ml.			THRESHOLD ODOR NO.			AMMONIA NITROGEN (ppm)			PHENOL (ppm)		
	MAX.	AVG.	NO. TESTS	MAX.	AVG.	NO. TESTS	MAX.	AVG.	NO. TESTS	MAX.	AVG.	NO. TESTS
101	24,000,000+	506,538	48	12 DfC	4	47	0.12	0.06	48	0.004	N.D.	48
102	2,400,000	68,019	43	13 DM	3	45	0.32	0.07	45	0.007	N.D.	45
103	2,400,000	102,449	47	35 MmD	4	47	0.22	0.05	46	0.004	0.001	47
104	2,400,000	66,742	48	15 DsM	4	47	0.24	0.08	48	0.004	N.D.	48
104 A	2,400,000	81,570	33	26 MCc	7	33	0.26	0.07	33	0.015	N.D.	33
106	2,400,000	94,116	52	12 Ds	5	52	0.64	0.08	52	0.005	N.D.	52
107	2,400,000	108,999	51	27 DsM	5	51	0.32	0.12	51	0.009	N.D.	51
109	2,400,000	97,087	50	11 DM	4	50	0.50	0.06	50	0.004	N.D.	50
110	2,400,000	55,442	49	55 Ch	5	49	0.60	0.07	49	0.004	N.D.	49
111	24,000,000	552,605	49	20 DsC	4	49	0.22	0.06	49	0.006	N.D.	49
112	2,400,000	62,729	49	20 Ds	4	49	0.24	0.05	49	0.004	N.D.	49
113	24,000,000	497,149	49	20 DsMm	4	50	0.20	0.05	50	0.005	N.D.	50
114	2,400,000	100,513	49	30 Ch	4	49	0.20	0.05	49	0.003	N.D.	49
115	24,000,000	544,769	49	25 Ch	4	49	0.24	0.05	49	0.006	0.001	49
116	2,400,000	51,442	49	40 Ds	6	49	0.24	0.06	49	0.005	N.D.	49
116 A	790	38	48	—	—	—	0.04	0.01	49	0.006	N.D.	49
17	240,000	10,075	52	15 DsM	4	52	0.22	0.05	52	0.006	N.D.	52
17 X	24,000,000	476,032	51	15 DMm	4	51	0.26	0.05	51	0.006	0.001	51
17XX	2,400,000	74,523	47	100 Ds	13	48	0.28	0.06	48	0.010	0.001	48

N.D.- NOT DETECTABLE
x ALL PARAMETERS NOT LISTED

WATER PURIFICATION DIVISION

FIGURE - 1

LAKE MICHIGAN FLUCTUATIONS
RECORDED AT CENTRAL WATER FILTRATION PLANT
1969



NOTE. CHICAGO CITY DATUM IS 579.88 FEET ABOVE MEAN TIDE LEVEL AT NEW YORK.
ELEVATIONS ARE EXPRESSED IN FEET.

WATER PURIFICATION DIVISION

.. OF CHICAGO - RICHARD J. DALEY, MAYOR
DEPARTMENT OF WATER AND SEWERS
BUREAU OF WATER
WATER DISTRIBUTION DIVISION

JAMES W. JARDINE
COMMISSIONER
RAYMOND D. JOHNSOS
DEPUTY COMMISSIONER
FOR WATER

JOSEPH P. GORMAN
ASSISTANT GENERAL SUPERINTENDENT

WILLIAM R. LEMM
DISTRIBUTION ENGINEER

ROOM 402, CITY HALL
CHICAGO, ILLINOIS - 60602
TELEPHONE 744-4000

1969 ANNUAL REPORT

WATER DISTRIBUTION DIVISION

Timothy F.Foley
General Superintendent
(January 1st to May 15th)

John D.Starr
General Superintendent
(June 1st to December 31st)

The operation, maintenance, planning, design, construction and inspection functions of the water distribution system are directed by the General Superintendent.

Mr.Timothy F.Foley, the General Superintendent since May 16,1968, retired on May 15,1969. Mr.Foley began his career with the Water Distribution Division in 1923.

Mr.John D.Starr was appointed General Superintendent effective June 1, 1969. Mr.Starr formerly assisted Mr.Foley in the capacity of Assistant General Superintendent.

The General Superintendent is assisted by Mr.J.P.Gorman, Assistant General Superintendent.

All engineering services in connection with the operation, maintenance, planning, design and construction of the water distribution system are directed by the Engineer of Water Distribution, William R.Lemm. The Engineer of Water Distribution is assisted in providing engineering services by Assistant Engineers, Joseph A.Thor, James J.Muldowney, Gilbert C. L.Brizzi, Richard F.Toblesky and Robert Zagars.

Mr.L.Brizzi was appointed Assistant Engineer effective March 10,1969.

Mr.Muldowney is on leave of absence as of August 16,1969.

Due to the size and complexity of the water distribution system, the City is divided into three sections for the purpose of maintenance and construction. These sections are not equal in area or in the length of pipe in the distribution system but are established on the basis of complexity and work forces required to maintain the distribution system.

The District Superintendents are responsible for the maintenance of the existing system and the supervision of the construction of additions to the system in their respective district.

North District Superintendent, George S.Osborne
Central District Superintendent, John Griffin
South District Superintendent, Henry J.Meehan

The basic responsibility of the Water Distribution Division is to transport water in sufficient quantity and at acceptable pressures from the eleven Pumping Stations to approximately 4.7 million consumers through a pipe network containing approximately 4,100 miles of water mains. In addition, the Water Distribution Division must provide sufficient water for fire protection within the corporate limits of the City of Chicago.

During 1969 new installations of pipe in the distribution system amounted to 106,932 feet (20.26 miles) of the following lengths and sizes: 180 feet of 4-inch; 1,673 feet of 6-inch; 48,760 feet of 8-inch; 16,599 feet of 12-inch; 3,927 feet of 16-inch; 13,615 feet of 24-inch; 2 feet of 30-inch; 18,802 feet of 36-inch; 2,517 feet of 42-inch; 683 feet of 48-inch; and 173 feet of 54-inch. Appurtenances added during 1969 amounted to 420 valves, 175 - 4½-inch double port hydrants, 23 fire cisterns and 20 pitometer basins.

Permanent abandonments during 1969 amounted to 53,573 feet (10.14 miles) of pipe in the following lengths and sizes: 23,035 feet of 6-inch; 20,815 feet of 8-inch; 6,012 feet of 12-inch; 2,652 feet of 16-inch; 332 feet of 24-inch; 715 feet of 36-inch; and 12 feet of 48-inch. Appurtenances abandoned during 1969 amounted to [illegible] valves and 82 - 4½-inch double port hydrants.

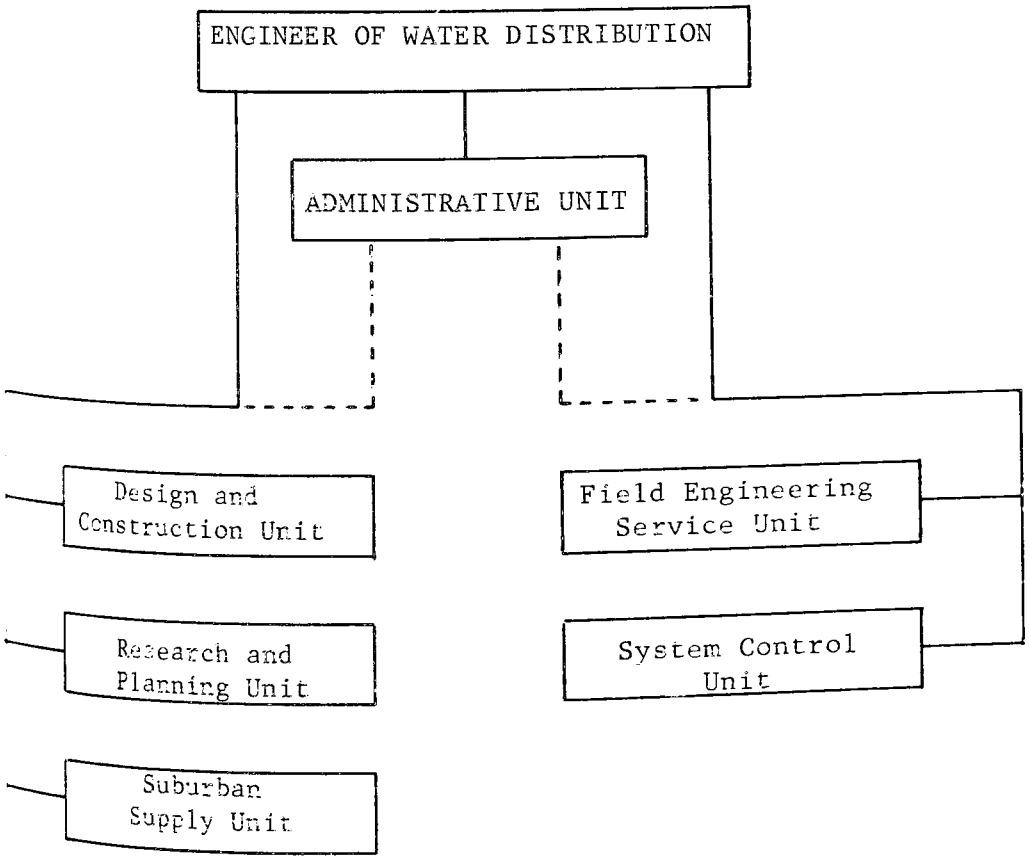
The revised statistics as of December 31,1969 for the water distribution system (excluding services) are 21,794,968 feet (4,127.83 miles) of pipe; 42,981 valves; 45,957 - 4½-inch double port hydrants; 480 fire cisterns; 478 blow-offs; and 1,066 pitometer basins.

Complete information concerning size, length, type of pipe, budget appropriation, etc., will be found in the following report.

The annual reports of the several sections of the Water Distribution Division, along with complete statistics on the operation of the system, follow this introduction.

WATER DISTRIBUTION DIVISION

ENGINEERING SECTION ORGANIZATIONAL CHART



ENGINEERING SECTION

William R.Lemm
Engineer of Water Distribution

The Engineering Section of the Water Distribution Division is responsible for the hydraulic analysis, design and operation of the distribution network and recommends operating pressures at Pumping Stations which will provide adequate pressures and the necessary volume of water for fire protection, domestic, industrial and commercial consumption for the 4.6 million consumers served by the Bureau of Water.

The Section is divided into six units: the Administrative Unit, the Design and Construction Unit, the Research and Planning Unit, the System Control Unit, the Suburban Supply Unit and the Field Engineering Service Unit.

Administrative Unit

The Administrative Unit of the Engineering Section is primarily responsible for the coordination of the activities of the various units within the Engineering Section. Representatives from this unit are present at all meetings involving matters that require the attendance of the Engineer of Water Distribution and/or unit supervisors. From the initiation of a project to its completion, this unit serves as a consultant and coordinator to and between the Engineer of Water Distribution, other units and other sections within the Division.

In addition, this unit maintains authority, personnel and attendance files, compiles cost and statistical data for all construction projects, and prepares correspondence and reports for the Engineering Section. The loss of several supervisory personnel assigned to the Administrative Unit has placed additional burdens upon the other understaffed units.

The advancement of draftsmen to civil engineering and engineering technician positions as a direct result of in-service training, which made it possible for them to pass civil service examinations, has created a shortage of drafting personnel. Replacements for the vacated positions are limited due to the length of service required in the various units to accumulate the necessary technical and practical experience in the specialized field of water distribution.

Much remains to be done in the field of recruiting talent to fill the vacancies existing in the technical area of our work.

System Control Unit

During 1969 personnel of the System Control Unit carried out maintenance, operation and inspection of (1) All Flow Control Systems located at suburban connections to the City's water system (2) All telemetric units located throughout the City (3) All water pressure gauges located in Fire Stations throughout the City (4) All water pressure gauges located in the City's eleven Pumping Stations (5) All Headquarters' telemetric equipment and (6) All regular and special reports relating to the Unit's work.

Field work is performed by engineering field parties working in the North, Central and South sections of the city under the supervision of the Engineer-in-Charge.

Flow Control System

The following Flow Control Systems were installed during 1969:

	Municipality	Date Installed		Location
1.	Cicero	April '69		S.S.Roosevelt Rd. E.of Cicero
2.	Park Ridge	Aug. '69	a)	W.S.Canfield at Rosedale
			b)	N.S.Touhy at Overhill
3.	Rosemont	Sept. '69		Bryn Mawr 1200' W.of River Rd.
4.	Stickney	Nov. '69		E.S.Cicero 200' S.of Drainage Canal

In addition, nine (9) municipalities are now planning for the installation of Flow Control Units during the year 1970. Thus, a total of 26 municipalities now have 33 flow control systems in full operation.

Members of the field forces regularly inspect each of these 33 systems and simple maintenance is effected, as well as changing flow and pressure charts, as needed. If any major repair on on any unit is required, the municipality involved is notified, in writing, to make and pay for such repairs.

Telemetering System

By Spring of 1969 all 32 units installed in 1968, with the exception of Nos. 1,5,51,53,145,251,259,265 and 295 were in full operation and sending continuous data to the receiving units in the headquarters' panels.

Even though the present installation is only a part of the overall system yet to be installed, its worth was demonstrated repeatedly as soon as it was functioning. To state only a few instances: During hot days the areas where hydrants were illegally opened were immediately evident; when valves were operated in the Mayfair and Roseland High service areas, the results were immediately evident and field forces were notified when to open or close these valves; several pumping stations maintained contact with headquarters to help in maintaining proper pressures in their respective areas.

During 1970 contracts will be let which will more than double the number of reporting points as well as the Pumping Station outlet pressures. It is worthy of note that this telemetric system, when completely installed, will be the largest and most modern telemetric system in the country, devoted to aiding a Water Department.

Fire Station Pressure Gauges

Sixty-one (61) water pressure gauges located in Fire Stations throughout the City form the basis of the 9:00 A.M. pressure report that is issued daily from the System Control Unit. Each Fire Station is called to report their 9:00 A.M. pressure, and the complete pressure survey is distributed to concerned members of the Bureau of Water. Field forces maintain these gauges on a regular schedule, seeing to it that these gauges are functioning properly and are well supplied with ink and charts.

Prior to March 9,1969, 75 Fire Stations were included in the 9:00 A.M. pressure survey. However, it was then determined that 14 Fire House gauges were each located within one mile of a telemetric reporting point and were dropped from the 9:00 A.M. report. These points were:

GAUGE NO.	LOCATION
110	6030 N.Avondale Av.
104	2718 N.Halsted
100	522 N.Webster
118	816 N.Laramie
21	2258 W.13th St.
211	13359 S.Burley Av.
6	3421 S.Calumet Av.
5	4005 S.Dearborn
218	7421 S.Western
226	9210 S.Chappel
213	3027 E.93rd St.
205	9241 S.Leavitt
231	3112 W.111th St.
203	11071 S.Hoyne Av.

Even though the above gauges have been dropped from the daily report they are serviced regularly and their charts are mailed to the Unit Headquarters.

Filing the daily pressure charts has been a problem over the years since some 27,375 charts were to be noted and stored. Early in 1969 a microfilm program was instituted and currently seven (7) charts, or one week's record, are microfilmed and the original charts are then placed in storage. Thus, microfilm records are now available to any concerned member of the Bureau of Water for any particular Fire Station gauge.

As more telemetric reporting points are installed during the coming years,more and more Fire Station gauges will be dropped from the 9:00 A.M.report until this type of telephone report can be phased out entirely.

Pumping Station Gauges

On July 8,1969 the Chief Water Engineer requested that the Unit make an investigation into the apparent discrepancies between the telemetering recordings and the recording in the Roseland Pumping Station. The results of this investigation proved that the Roseland gauges were faulty and were recording 61 psi when the actual pressure was 68 psi. The station gauges were then recalibrated and later replaced with more reliable instruments.

The System Control Unit was then instructed to make a thorough check of every Pumpimg Station gauge which resulted in still other minor adjustments. Since that time all Pumping Station gauges are regularly checked and serviced.

In December of 1969 the Unit started plans and specifications for the telemetering of the Pumping Station gauges so that the output pressure of each station will be recorded on the Unit's Headquarters' panels. Telemetric recordings of these pressures is essential in understanding system pressures now recorded. It is anticipated that this work will be under contract by February 1970, to be completed before the summer of this year.

Headquarters Equipment

The Headquarters for this Unit is in Room 3031 on Elevation +51 at the Central District Filtration Plant. Here are stored all records and telemetric receiving equipment, 32 receiving instruments are housed in two free-standing cabinets. Each receiving instrument has its own group of controls which are constantly monitored during business hours but recording is continuous throughout every 24-hour period. A daily record of the hourly recorded pressures is distributed by this Unit, together with the 9:00 A.M. telephone report mentioned above.

This equipment is maintained by Headquarters' personnel. Such maintenance includes chart changing and inking, meter calibration, circuit tracing, changing fuses, checking and servicing solid-state circuitry and maintaining over-all system operation. Since this equipment was under warranty during the entire year of 1969, the Hersey-Sparling people made any major repairs without cost.

To aid maintenance work the Unit has some test equipment which greatly simplifies the maintenance procedures.

During 1970, this Headquarters' equipment will be greatly expanded to include two more cabinets and a graphic panel capable of displaying all present and future pressure reporting points, control valves, etc

Water Supplied to Suburban Municipalities
and other Consumers outside the City Limits

During the year 1969 an average of 162.349 million gallons per day was supplied to all consumers of water outside the Chicago corporate limits, as follows:

	MGD
Suburban Municipalities (72)	152.746
Western Electric Company, 26th St. and Kenton Av.	4.439
Railroads	1.349
Other Consumers	3.815
TOTAL CONSUMPTION OUTSIDE CORPORATE LIMITS	162.349
Charitable and free water charged to Chicago	.449
TOTAL CONSUMPTION CHARGED FOR	161.900

Of the seventy-two (72) suburban municipalities supplied by the City of Chicago, four were partially supplied with well water - Des Plaines, Lyons, Riverside and Hickory Hills. The estimated population served in the suburban municipalities was 1,174,570 and the average daily consumption was 130 gpcd (gallons per capita per day). The total estimated population serviced outside the city's corporate limits was 1,186,570 and the average daily consumption was 136 gpcd (gallons per capita per day).

Water supply contracts passed by the City Council during the year 1969 are given in the following table:

Municipalities	Contract Ordinance Passed by City Council	Annual Average Supply mgd	Year	Maximum Rate of Supply mgd
Village of Hometown	3-14-69	0.530	1968	0.848
		0.620	1977	0.992
Village of Harwood Heights	6-23-69	1.250	1969	2.000
		1.390	1978	2.220
Village of Summit	7-8-69	1.360	1969	2.180
		1.380	1978	2.210
Village of Melrose Park and including Leyden Township, City of Northlake and Village of Stone Park	12-9-69	9.800	1969	19.600
		11.606	1978	23.212
Village of Melrose Park 1st Amendment to Contract for water supply to Village of Maywood	12-9-69	3.100	1969	6.20
		3.760	1978	7.52

Municipalities	Contract Ordinance Passed by City Council	Annual Average Supply mgd	Year	Maximum Rate of Supply mgd
Village of Melrose Park 2nd Amendment to Contract for water supply to Hillside-Berkeley Water Commission	12-9-69	2.100 2.850	1969 1978	4.200 5.700
*City of Berwyn	12-9-69	6.950 7.670	1969 1978	13.900 15.340
Village of McCook including Village of Hodgkins and City of Countryside	12-30-69	5.520 6.934	1969 1978	9.064 11.483

* Note: Contract Ordinance passed by City Countil on 1-15-65 for water supply to City of Berwyn repealed by Ordinance passed by City Council on 12-9-69.

SUBURBAN MUNICIPALITIES SUPPLIED BY CHICAGO WATER WORKS SYSTEM - DECEMBER 31, 1969

Municipality	Est. Pop. Supplied	Average Consumption mgd-1969
Alsip	11,710	1.258
Bedford Park	1,000	10.468
Berkeley hb-mp	7,080	(1)
Berwyn	57,970	6.958
Blue Island	23,290	3.367
Bridgeview	13,610	1.285
Broadview bw	11,180	(2)
Brookfield bn	22,610	2.729
Burnham cal	3,500	0.280
Calumet City	34,170	3.536
Calumet Park	10,600	1.059
Central Stickney S.D.	2,750	0.019
Chicago Ridge ol	9,890	0.521
Cicero	71,930	13.908
Countryside mc	3,100	0.344
Crestwood a	5,030	0.262
*Des Plaines	35,680	4.433
Dixmoor h	4,200	0.513
Dolton	27,020	2.932
East Hazel Crest ic	1.790	0.105
Elmwood Park	29,820	2.744
Evergreen Park	27,610	2.785
Forest Park	17,900	2.318
Forest View	1,800	0.162
Franklin Park	20,990	4.663
Garden Homes S.D.	1,800	0.056
Golf mg	850	0.060
Harvey	34,530	5.055
Harwood Heights	9,720	1.191
Hazel Crest h	10,400	0.712
*Hickory Hills jw	7,660	0.521
Hillside hb-mp	10,370	1.823
Hodgkins mc	1,700	0.152
Hometown	7,550	0.462
Justice jw	6,200	0.728
La Grange Park bn	16,870	1.358
Leyden Township mp	9,000	1.100
Lincolnwood	13,900	3.245
*Lyons bn	5,560	0.514
Markham h	15,950	1.062
Maywood mp	29,760	2.693
McCook	520	5.134
Melrose Park	27,930	5.676
Merrionette Park	3,250	0.150
Midlothian rb	13,510	1.028
Morton Grove	27,200	4.233
Niles	32,630	3.952
Norridge	19,010	1.592
Northlake mp-nwr	15,230	1.654
N. Riverside bn	9,110	(3)
Oak Lawn	62,360	4.838
Oak Park	63,480	6.734
Palos Heights a	8,490	0.555
Palos Hills ol	8,450	0.324
Park Ridge	41,550	5.464
Phoenix h	4,800	0.308
Posen h	5,440	0.418
Riverdale	15,200	3.759
River Forest	14,050	1.742
River Grove	14,080	1.587
*Riverside bn	1,410	0.117
Robbins	9,050	1.393
Rosemont	6,070	1.027
Schiller Park	14,060	2.201
South Holland	24,820	1.861
South Stickney S.D.	35,500	2.049
Stickney	7,360	0.833
Stone Park mp	5,270	0.387
Summit	12,030	1.366
Westchester bw	21,060	4.278
Willow Springs jw	3,600	(4)
Worth	10,000	0.705
TOTAL	1,174,570	152.746

SUPPLIED BY

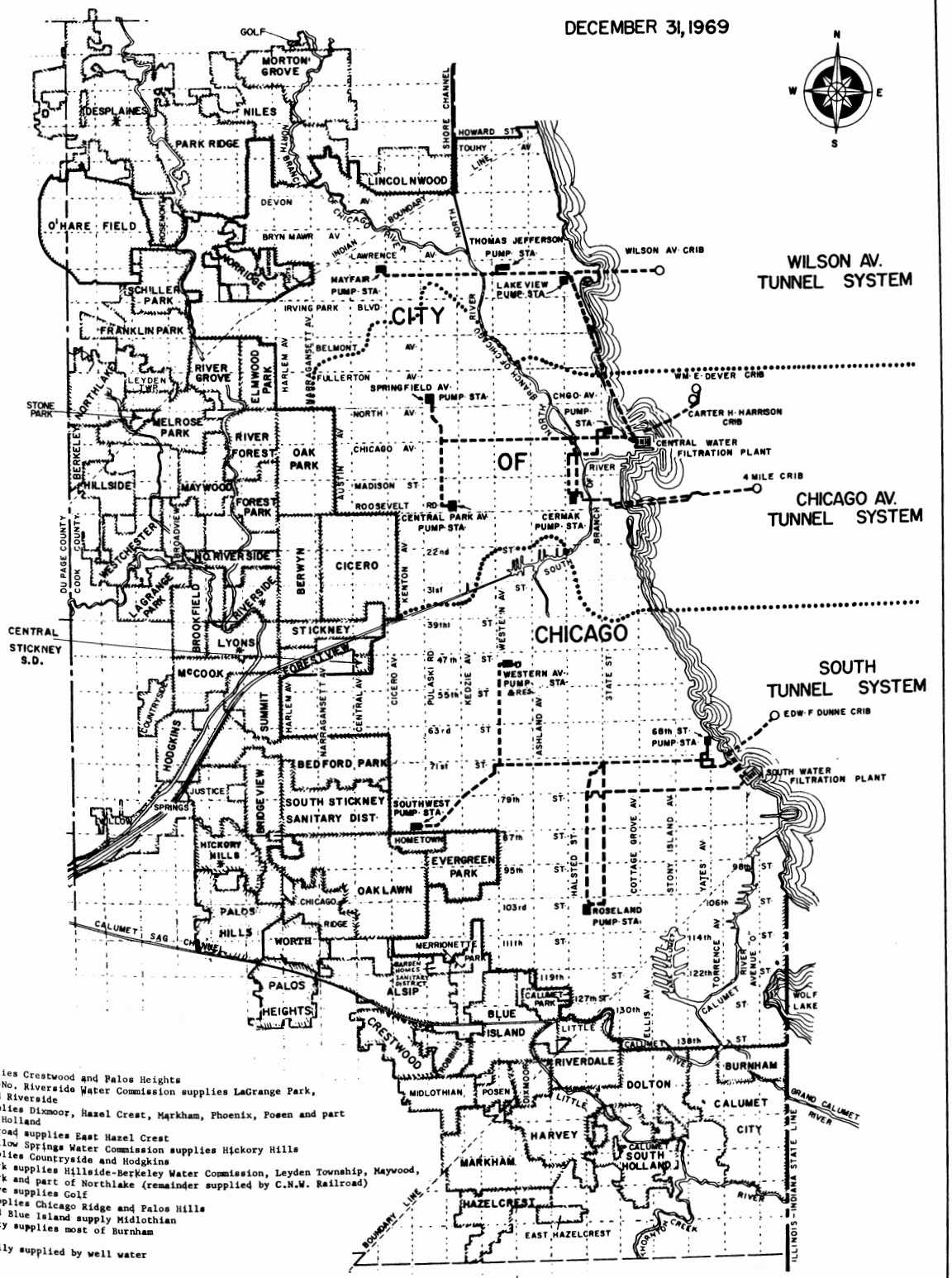
a	Alsip
hb	Hillside Berkeley Water Comm.
bw	Broadview-Westchester
bn	Brkfld.-N.Riverside Water Comm.
cal	Calumet City and City of Chicago
ol	Oak Lawn
mc	McCook
h	Harvey
ic	Illinois Central RR
mg	Morton Grove
jw	Justice-Willow Spgs. Water Comm.
mp	Melrose Park
rb	Robbins & Blue Island
nwr	Northwestern RR
*	Partial population only. Remainder of population supplied from wells.
(1)	Berkeley included in Hillside
(2)	Broadview included in Westchester
(3)	N.Riverside included in Brookfield
(4)	Willow Springs included in Justice

CONSUMPTION OUTSIDE CITY LIMITS

Municipalities	152.746 mgd
Western Electric Co.	4.439 "
Railroads	1.349 "
Other Consumers	3.815 "
TOTAL	162.349 mgd
Charitable and Free water (Charged to Chicago)	.449 mgd
NET TOTAL	161.900 mgd
Total Population Served	1,186,570
Outside Chicago City Limits per Capita	136 gpd

CHICAGO AREA MAP

MUNICIPALITIES SUPPLIED FROM CHICAGO WATER WORKS SYSTEM



Alsip supplies Crestwood and Palos Heights
Brookfield-No. Riverside Water Commission supplies LaGrange Park, Lyons and Riverside
Harvey supplies Dixmoor, Hazel Crest, Markham, Phoenix, Posen and part of South Holland
I. C. Railroad supplies East Hazel Crest
Justice-Willow Springs Water Commission supplies Hickory Hills
McCook supplies Countryside and Hodgkins
Melrose Park supplies Hillside-Berkeley Water Commission, Leyden Township, Maywood, Stone Park and part of Northlake (remainder supplied by C.N.W. Railroad)
Morton Grove supplies Golf
Oaklawn supplies Chicago Ridge and Palos Hills
Robbins and Blue Island supply Midlothian
Calumet City supplies most of Burnham

* partially supplied by well water

Design and Construction Unit

The Design and Construction Unit of the Engineering Section performed the following functions during 1969:

Prepared plans and estimates of cost and provided engineering supervision for the installation of 106,932 feet and the abandonment of 53,573 feet of water mains. (See tables following this report.)

Coordinated the inspections, investigations and other work efforts by the various units of the Engineering Section, and other sections of the Water Distribution Division on the expanded grid main replacement program.

Maintained an original tracing file of Atlas Pages showing all water mains and appurtenances within the City of Chicago and corrected these files to reflect the addition of 106,932 feet and the abandonment of 53,573 feet of water mains and appurtenances and prepared "Record Drawings" of these mains. Checked approximately 1,744 "Completed Foreman's Reports" to determine if the information was correct and had been properly entered on the "Record Drawing," original Atlas Pages and on the official Atlas.

Represented the Bureau of Water at all meetings of the Board of Underground Work of Public Utilities of the City of Chicago, preconstruction meetings with the Department of Public Works, Bureau of Engineering, State of Illinois Highway Department, Cook County Highway Department and other private and semi-public agencies or individuals in connection with the adjustment, relocation or abandonment of existing water mains and appurtenances and the installation and coordination of new construction.

Reviewed approximately 375 applications for construction permits from the Peoples Gas Light and Coke Company, Commonwealth Edison Company, Illinois Bell Telephone Company and checked these plans for conflict with existing or proposed water mains and appurtenances prior to approving the permit application.

Distributed approximately 14,000 corrected Atlas pages to the City Hall, District Superintendents and the Field Engineering Service Unit, and approximately 3000 service pipe plats for engineering design and plumbing inspection.

Reviewed and prepared correspondence and drawings for approximately 1400 requests for information in connection with the proposed vacations of streets and alleys, proposed street improvements by the Board of Local Improvements, proposed street resurfacing, reconstruction or channelization by the Department of Streets and Sanitation, proposed redevelopment projects by the Department of Urban Renewal and the Chicago Housing Authority, proposed sewer projects sponsored by the Bureau of Sewers of the Department of Public Works, bridge reconstruction projects, and other requests for information from public and private agencies who were preparing plans for new buildings or the expansion of existing facilities and required the location of existing or proposed water mains and appurtenances.

Drafted maps, graphs, tables and sketches necessary for special studies, reports, maps of the distribution system and other drafting, as required.

Photographed various water distribution construction projects, as to sidewalks, parkways and streets in advance of pipe laying projects to provide a record of existing conditions prior to commencement of construction work.

The in-service training program was expanded because of the increased shortage of engineering personnel. Senior draftsmen, under a supervising engineer, have been assigned additional duties on the field investigation, design, estimating and construction of grid main replacement projects. The object of this training is to shift these men to engineering technician work thus allowing engineers to direct their efforts to more complex projects. Additional training of all engineering personnel regarding various domestic and fire demands and network analysis in major redevelopment areas by use of the "360" computer.

FEEDER MAINS PLACED IN SERVICE IN 1969

Work Order No.	Location	Length in Feet	Size in Inches
31975	St. Louis Av. - Carmen Av. to Bryn Mawr Av.	1023'	24" D.I.
	Bryn Mawr Av. - St. Louis Av. to Central Park Av.	90'	36" D.I.
	Central Park Av. - Bryn Mawr Av. to Rosemont Av.	4989'	36" Conc.
	Rosemont Av. - Central Park Av. to Avers Av.		
	Avers Av. - Rosemont Av. to Devon Av.		
	5824 feet of 24-inch ductile iron pipe was included in the 1968 Report.		
31975 1st Supp.	St. Louis Av. -	43'	24" D.I.
	Ainslie Av. to 560 feet N.N.L. Ainslie Av.	521'	36" Conc.
31975 2nd Supp.	Bryn Mawr Av. - Central Park Av. to Kilbourn Av.	8709'	36" Conc.
	Kilbourn Av. - Bryn Mawr Av. to Rogers Av.		
	Caldwell Av. - Kilbourn Av. to Cicero Av.		
31995	Cumberland Av. - Addison St. to Foster Av.	4'	24" D.I.
		168'	36" D.I.
	9.803 feet of 36-inch concrete pipe was included in the 1968 Report.	1062'	36" Conc.
24718	Wilson Av. - Laporte Av. to Lavergne Av.	48'	36" C.I.
	Lavergne Av. - Wilson Av. to Agatite Av.	58'	36" D.I.
	Agatite Av. - Lavergne Av. to Laramie Av.	2'	36" Conc.
	Laramie Av. - Agatite Av. to Berteau Av.	68'	48" C.I.
	Berteau Av. - Laramie Av. to Narrangansett Av.	164'	48" D.I.
		115'	48" Conc.
		173'	54" Conc.
	1,198 feet of 48-inch concrete pipe and 10,594 feet of 54-inch concrete pipe were included in the 1968 Report.		
36404 1st Supp.	East River Rd. - North R.O.W. of Kennedy Expressway to Higgins Rd.	2940'	24" D.I.
	Higgins Rd. - East River Rd. to 1788 feet E.E.L. East River Rd.		
24817	Wabash Av. - Pershing Rd. to 35th St.	2595'	24" D.I.
28755	Chicago Av. - Green St. to Halsted St.	957'	24" D.I.
34644	35th Street Bridge	379'	24" D.I.
32070	Harper Av. -	74'	36" D.I.
	189 feet to 407 feet N.N.L. Hyde Park Blvd.	156'	36" Conc.

FEEDER MAINS PLACED IN SERVICE IN 1969 (Continued)

Work Order No.	Location	Length in Feet	Size in Inches
32096	43rd St. - Racine Av. to Ashland Av.	114'	24" D.I.
		86'	36" D.I.
		2666'	36" Conc.
		5'	48" D.I.
		16'	48" Conc.
32097	Racine Av. - 47th St. to Pershing Rd.	5270'	24" D.I.
		2'	30" D.I.
		40'	36" Conc
		304'	48" Conc
28754	Chicago Av. - 36 feet W.W.L. Green St. to 165 feet E.E.L. Green St. Halsted St. - Superior St. to 100 feet S.S.L. Superior St.	265'	24" D.I
34505	18th St. - State St. to 37 feet E.E.L. State St.	25'	24" D.I.
34853	Pulaski Rd. - 111th St. to 115th St.	2517'	42" Conc.
		133'	36" Conc.

PIPE PLACED IN SERVICE (IN FEET) DURING 1969 ACCORDING TO BUDGET APPROPRIATION

BUDGET APPROPRIATION		4"	6"	8"	12"	16"	24"	30"	36"	42"	48"	54"	60"	TOTALS	MILES PIPE
FEEDER MAINS			247	634	200	146	5001		15707		347	173		22,455	4.25
SMALLER MAINS			498	23613	4351	1835					12			30,309	5.74
WATER MAIN BETTERMENTS			236	4250	974	767								6,227	1.18
FIRE PROTECTION															
REHABILITATION															
MISC. CONSTRUCTION		180	31	2388	73									2,672	0.51
REVOLVING FUND			661	17875	11001	1179	8614	2	3095	2517	325			45,269	8.58
ACQUIRED BY ANNEXATION															
TOTALS IN FEET		180	1673	48760	16599	3927	13615	2	18802	2517	684	173		106,932	
TOTALS IN MILES		0.03	0.32	9.24	3.14	0.75	2.58	0	3.56	0.48	0.13	0.03			20.26

PIPE PLACED IN SERVICE (IN FEET) DURING 19 , BY DISTRICTS

DISTRICT		4"	6"	8"	12"	16"	24"	30"	36"	42"	48"	54"	60"	TOTAL FEET	TOTAL MILES
NORTH			59	2257	2229	275	4010		15647		359	173		25,009	474
CENTRAL			1218	24660	11275	3471	9605	2	3022		325			53,578	10.15
SOUTH		180	396	21843	3095	181			133	2517				28,345	5.37
TOTALS		180	1673	48760	16599	3927	13615	2	18802	2517	684	173		106,932	20.26

PIPE IN SERVICE AT END OF 1969
PIPE PLACED IN SERVICE AND PIPE ABANDONED DURING 1969

SIZE OF PIPE	PIPE PLACED IN SERVICE IN 1969	PIPE ABANDONED DURING 1969	NET DIFFERENCE +INCREASE -DECREASE	FEET OF PIPE IN SERVICE AS OF		MILES OF PIPE IN SERVICE AS OF DEC. 31, 1969
				DEC. 31, 1968	DEC. 31, 1969	
4"	180	0	+180	63,074	63,254	11.98
6"	1,673	23,035	- 21,362	5,927,805	5,906,443	1118.65
8"	48,760	20,815	+ 27,945	9,699,509	9,727,454	1842.32
10"				26,238	26,238	4.97
12"	16,599	6,012	+ 10,587	3,062,586	3,073,173	582.04
14"				25,010	25,010	4.74
16"	3,927	2,652	+ 1,275	608,028	609,303	115.40
20"				85,239	85,239	16.14
24"	13,615	332	+ 13,283	762,463	775,746	146.92
30"	2	0	+ 2	263,905	263,907	49.98
36"	18,802	715	+ 18,087	808,756	826,843	156.60
42"	2,517	0	+ 2,517	88,179	90,696	17.18
48"	684	12	+ 672	264,299	264,971	50.18
54"	173	0	+ 173	42,140	42,313	8.01
60"				14,378	14,378	2.72
TOTAL IN FEET	106,932	53,573	+ 53,359	21,741,609	21,794.968	
TOTAL IN MILES	20.26	10.14	+ 10.12	4117.71		4,127.83

MAINS IN SERVICE AT END OF 1969

SHOWING AMOUNTS IN FEET AND IN MILES

BY SIZES IN EACH DISTRICT

SIZE OF PIPE	NORTH DISTRICT	CENTRAL DISTRICT	SOUTH DISTRICT	TOTAL	
				FEET	MILES
4"	26,930	34,166	2,158	63,254	11.98
6"	2,023,222	1,506,072	2,377,149	5,906,443	1118.65
8"	4,046,899	1,570,572	4,109,983	9,727,454	1842.32
10"	9,108	6,577	10,553	26,238	4.97
12"	1,070,890	901,561	1,100,722	3,073,173	582.04
14"	2,550	4,600	17,860	25,010	4.74
16"	130,471	264,756	214,076	609,303	115.40
20"	45,047	7,450	32,742	85,239	16.14
24"	239,390	270,611	265,745	775,746	146.92
30"	71,527	91,795	100,585	263,907	49.98
36"	260,346	246,899	319,598	826,843	156.60
42"	40,245	12,400	38,051	90,696	17.18
48"	95,057	92,563	77,351	264,971	50.18
54"	30,475	5,726	6,112	42,313	8.01
60"	2,182		12,196	14,378	2.72
TOTAL	8,094,339	5,015,748	8,684,881	21,794,968	
MILES	1533.02	949.95	1644.86		4,127.83

TYPE OF PIPE IN SERVICE BY DISTRICTS IN FEET-END OF 1969

SIZE OF PIPE IN DISTRICT		CAST IRON	DUCTILE IRON	CONCRETE	STEEL	TOTAL PIPE IN SERVI DISTRICT	CITY
4"	North	26,930				26,930	
	Cent.	34,166				34,166	
	South	1,978	180			2,158	63,2
6"	North	2,020,502	2,673		47	2,023,222	
	Cent.	1,496,184	9,888			1,506,072	
	South	2,365,074	12,075			2,377,149	5,906,4
8"	North	3,967,096	67,537		12,266	4,046,899	
	Cent.	1,453.783	114,561		2,228	1,570,572	
	South	3,956,627	153,356			4,109,983	9,727,45
10"	North	9,108				9,108	
	Cent.	6,577				6,577	
	South	10,553				10,553	26,23
12"	North	1,032,206	36,710		1,974	1,070,890	
	Cent.	819,536	74,466		7,559	901,561	
	South	1,046,205	52,417		2,100	1,100,722	3,073,17
14"	North	2,550				2,550	
	Cent.	4,600				4,600	
	South	17,860				17,860	25,01
16"	North	120,120	9,470		881	130,471	
	Cent.	242,838	15,018		6,900	264,756	
	South	193,200	20,876			214,076	609,303
18"							
20"	North	45,047				45,047	
	Cent.	6,800			650	7,450	
	South	32,742				32,742	85,239
24"	North	226,482	11,092		1,816	239,390	
	Cent.	247,259	23,352			270,611	
	South	258,343	6,502		900	265,745	775,746
30"	North	54,044	10,124	6,010	1,349	71,527	
	Cent.	85,359	426	6,010		91,795	
	South	54,516		46,069		100,585	263,907
36"	North	191,491	438	68,417		260,346	
	Cent.	198,783	4,329	40,497	3,290	246,899	
	South	199,901	128	119,569		319,598	826,843
42"	North	22,430		17,815		40,245	
	Cent.	12,400				12,400	
	South	6,740	8,100	23,211		38,051	90,696
48"	North	34,538	15,110	45,409		95,057	
	Cent.	53,287	5,324	33,172	780	92,563	
	South	31,100		46,251		77,351	264,97
54"	North	4,484		25,991		30,475	
	Cent.	251		5,475		5,726	
	South			6,112		6,112	42,31
60"	North			2,182		2,182	
	Cent.						14,37
	South			12,196		12,196	
TOTAL	NORTH	7,757,028	153,154	165,824	18,333	8,094,339	
	CENT.	4,661,823	247,364	85,154	21,407	5,015,748	21,794,96
	SOUTH	8,174,839	253,634	253,408	3,000	8,684,881	
	CITY	20,593,690	654,152	504,386	42,740	21,794,968	21,794,96

TYPE OF PIPE IN SERVICE IN FEET AND MILES-END OF 1969

SIZE	CAST IRON	DUCTILE IRON	CONCRETE	STEEL	TOTAL PIPE IN SERVICE	
					FEET	MILES
4"	63,074	180			63,254	11.98
6"	5,881,760	24,636		47	5,906,443	1118.65
8"	9,377,506	335,454		14,494	9,727,454	1842.32
10"	26,238				26,238	4.97
12"	2,897,947	163,593		11,633	3,073,173	582.04
14"	25,010				25,010	4.74
16"	556,158	45,364		7,781	609,303	115.40
18"						
20"	84,589			650	85,239	16.14
24"	732,084	40,946		2,716	775,746	146.92
30"	193,919	10,550	58,089	1,349	263,907	49.98
36"	590,175	4,895	228,483	3,290	826,843	156.60
42"	41,570	8,100	41,026		90,696	17.18
48"	118,925	20,434	124,832	780	264,971	50.18
54"	4,735		37,578		42,313	8.01
60"			14,378		14,378	2.72
TOTAL FEET	20,593,690	654,152	504,386	42,740	21,794,968	
TOTAL MILES	3900.32	123.89	95.53	8.09		4127.83

HYDRANTS, FIRE CISTERNS, BLOW-OFFS AND PITOMETER BASINS INSTALLED, ABANDONED AND IN SERVICE - 1969

DISTRICT		FIRE HYDRANTS	FIRE CISTERNS				BLOW-OFFS					PITOMETER BASINS
			6"	8"	12"	TOTAL	4"	6"	8"	12"	TOTAL	
NORTH	INSTALLED	36		2	13	15						18
	ABANDONED	1		0	0	0						0
	NET CHANGE	+35		+2	+13	+15						+ 18
	IN SERVICE END '68	16,607	38	50	31	119	1	86	58	12	157	216
	IN SERVICE END '69	16,642	38	52	44	134	1	86	58	12	157	234
CENTRAL	INSTALLED	98		7	1	8						2
	ABANDONED	49		0	0	0						0
	NET CHANGE	+49		+7	+1	+8						+2
	IN SERVICE END '68	11,512	109	151	23	283	6	20	24	2	52	484
	IN SERVICE END '69	11,561	109	158	24	291	6	20	24	2	52	486
SOUTH	INSTALLED	41										
	ABANDONED	32										
	NET CHANGE	+ 9										
	IN SERVICE END '68	17,745	17	24	14	55		73	155	41	269	346
	IN SERVICE END '69	17,754	17	24	14	55		73	155	41	269	346
TOTAL	INSTALLED	175		9	14	23						20
	ABANDONED	82		0	0	0						0
	NET CHANGE	+93		+ 9	+14	+ 23						+20
	IN SERVICE END '68	45,864	164	225	68	457	7	179	237	55	478	1,046
	IN SERVICE END '69	45,957	164	234	82	480	7	179	237	55	478	1,066

WATER MAIN BREAKS REPAIRED DURING 1969

DISTRICT	4"	6"	8"	10"	12"	14"	16"	20"	24"	30"	36"	42"	48"	54"	60"	TOTAL
NORTH		32	13		11		1									57
CENTRAL		74	40		5											119
SOUTH		15	26		4				1							46
TOTALS		121	79		20		1		1							222

VALVES – INSTALLED, ABANDONED AND IN SERVICE – END OF 1969

	SIZE	4"	6"	8"	10"	12"	14"	16"	~~18"~~ 54"	20"	24"	30"	36"	42"	48"	TOTAL
NORTH DISTRICT	INSTALLED		12	23		39		6	4		9		12		9	114
	ABANDONED		0	0		-2		0	0		0		-2		0	- 4
	NET CHANGE		+12	+23		+37		+ 6	+ 4		+ 9		+10		+ 9	+110
	IN SERVICE END'68	71	4146	8007	8	2188	3	337	0	13	186	8	169	20	10	15,166
	IN SERVICE END'69	71	4158	8030	8	2225	3	343	4	13	195	8	179	20	19	15,276
CENTRAL DISTRICT	INSTALLED		23	93		77		20			16		4			233
	ABANDONED		-42	- 15		-4		-8								- 69
	NET CHANGE		-19	+ 78		+ 73		+ 12			+16		+ 4			+164
	IN SERVICE END'68	49	4092	4524	2	728	3	734			305	9	187	9	1	12,643
	IN SERVICE END'69	49	4073	4602	2	801	3	746			321	9	191	9	1	12,807
SOUTH DISTRICT	INSTALLED	1	6	50		14							2			73
	ABANDONED	0	-6	-17		-1							0			-24
	NET CHANGE	+1	0	+33		+13							+2			+49
	IN SERVICE END'68	16	4789	7276	23	1969	13	340		11	214	15	164	19		14,849
	IN SERVICE END'69	17	4789	7309	23	1982	13	340		11	214	15	166	19		14,898
TOTAL	INSTALLED	1	41	166		130		26	4		25		18		9	420
	ABANDONED	0	-48	-32		- 7		-8	0		0		-2		0	-97
	NET CHANGE	+1	-7	+134		+123		+18	+4		+ 25		+16		+ 9	323
	IN SERVICE END'68	136	13027	19807	33	6885	19	1411		24	705	32	520	48	11	42,658
	IN SERVICE END'69	137	13020	19941	33	7008	19	1429	4	24	730	32	536	48	20	42,981

PIPE INSTALLED IN NORTH DISTRICT - 1969

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
24718	Wilson Av.	Laporte Av.	Lavergne Av.	54" Conc.	173'	5	2-8"
	Lavergne Av.	Wilson Av.	Agatite Av.	48" Conc.	115'		8-12"
	Agatite Av.	Lavergne Av.	Laramie Av.	48" Duct.	164'		2-36"
	Laramie Av.	Agatite Av.	Berteau Av.	48" C.I.	68'		7-48"
	Berteau Av.	Laramie Av.	Narragansett Av.	36" Conc.	2'		4-54"
				36" Duct.	58'		
				36" C.I.	48'		
				16" Duct.	23'		
				12" Duct.	60'		
				8" Duct.	438'		
				6" Duct.	19'		
				6" C.I.	6'		
28551	Bryn Mawr Av.	257' EEL Kedzie Av.	317' EEL Kedzie Av.	16" Duct.	129'		
31938	Foster Av.	East River Rd.	Potawatomie Av.	12" Duct.	1220'	4	1-8"
	East River Rd.	Foster Av.	212' NNL Foster Av.	8" Duct.	430'		1-12"
	Oakview Av.	Foster Av.	Berwyn Av.				
31975	St. Louis Av.	Carmen Av.	Bryn Mawr Av.	36" Conc.	4989'	6	6-6"
	Bryn Mawr Av.	St. Louis	619' WWL Central Pk.Av.	36" Duct.	90'		7-12"
	Central Pk. Av.	Bryn Mawr Av.	Rosemont Av.	24" Duct.	1023'		4-24"
	Rosemont Av.	Central Pk. Av.	Avers Av.				3-36"
	Avers Av.	Rosemont Av.	Devon Av.				
31975	St. Louis Av.	Ainslie Av.	560' NNL Ainslie Av.	36" Conc.	521'		1-8"
1st Supp.				24" Duct.	43'		1-12"
							1-24"
31975	Bryn Mawr Av.	619' WWL Central Pk.Av.-Kilbourn Av.		36" Conc.	8709'	6	1-6"
2nd Supp.	Kilbourn Av.	Bryn Mawr Av.	Rogers Av.				4-8"
	Caldwell Av.	Kilbourn Av.	Cicero Av.				10-12"
							1-16"
							3-36"
31993	Clark St.	Wisconsin St.	Belden Av.	8" Duct.	130'	1	1-8"

PIPE INSTALLED IN NORTH DISTRICT - 1969 (Continued)

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
31995	Cumberland Av.	Addison St.	Foster Av.	36" Conc.	1062'	4	2-6"
				36" Duct.	168'		7-12"
				24" Duct.	4'		4-16"
				16" Duct	123'		4-36"
				12" Duct.	110'		
				8" Duct.	16'		
				6" Duct	10'		
31998	Lawrence Av.	24' EWL Pueblo Av.	131' WWL Pueblo Av.	12" Duct	146'		1-16"
34709	Potawatomie Av.	Leland Av.	395' NNL Leland Av.	8" Duct.	398'	1	1-8"
34712	Holly Av.	52' SE Schubert Av.	-102' SE Schubert Av.	8" Duct.	55'		
34734	Kennedy Expwy. Median at Lamon Av. and Wilson Av.			48" Duct.	12'		2-48"
34796	Sheffield Av. at Wellington Av.			8" Duct.	28'		
36404	East River Rd.	Kennedy Expwy.	Higgins Rd.	24" Duct.	2940'	6	11-8"
1st Supp.	Higgins Rd.	East River Rd.	- 1788' EEL East River Rd.	12" Duct.	32'		1-12"
2nd Supp.				8" Duct.	140'		4-24"
				6" Duct.	15'		
36431	Catherine Av.	Pueblo Av.	394' WWL Pueblo Av.	12" Duct.	400'	1	1-12"
				6" Duct.	9'		
36440	Cornelia Av.	Pacific Av.	Panama Av.	8" Duct.	622'		1-8"
36472	Easement -	Ogden Av. and Evergreen Av.		12" Duct.	261'	1	3-12"

PIPE INSTALLED IN CENTRAL DISTRICT - 1969

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
24817	Wabash Av.	Pershing Rd.	35th St.	24" Duct.	2595'	2	2-6"
				12" Duct.	30'		7-8"
				8" Duct.	72'		2-12"
				6" Duct.	32'		3-16"
28677	35th Pl.	California Av.	Rockwell St.	16" Duct.	350'	10	1-6"
	Rockwell St.	35th Pl.	40th St.	12" Duct.	90'		6-8"
				8" Duct.	2852'		1-16"
28754	Chicago Av.	36' WWL Green St.	165' EEL Green St.	24" Duct.	265'	1	2-6"
	Halsted St.	Superior St.	100' SSL Superior St.	16" Duct.	4'		1-8"
				8" Duct.	69'		1-24"
28755	Chicago Av.	165' EEL Green St.	769' EEL Halsted St.	24" Duct.	957'	2	3-6"
				8" Duct.	98'		5-8"
				6" Duct.	108'		2-24"
32070	Harper Av.	189' NNL Hyde Pk.Blvd.	407' NNL Hyde Pk.Blvd.	36" Duct.	74'		
				36" Duct.	156'		
32096	43rd St.	Racine Av.	Ashland Av.	48" Duct.	5'	10	1-6"
				48" Conc.	16'		28-12"
				36" Duct.	86'		1-16"
				36" Conc.	2666'		2-24"
				24" Duct.	114'		4-36"
				16" Duct.	218'		
				12" Duct.	3103'		
				8" Duct.	8'		
				6" Duct.	90'		
32097	Racine Av.	47th St.	Pershing Rd.	48" Conc.	304'	17	1-6"
				36" Conc.	40'		15-8"
				30" Duct.	2'		11-12"
				24" Duct.	5270'		11-24"
				16" Duct.	60'		
				12" Duct.	625'		
				8" Duct.	202'		
				6" Duct.	88'		

PIPE INSTALLED IN CENTRAL DISTRICT - 1969 (Continued)

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
32097	Racine Av.	Intersection Transit Av.		12" Duct.	67'		
2nd Supp.				8" Duct.	24'		
32137	16th St.	Laflin St.	Racine Av.	12" Duct.	1792'	10	1-6"
	Laflin St.	Polk St.	Congress Parkway	8" Duct.	1795'		4-8"
	Congress Parkway	Laflin St.	Loomis St.	6" Duct.	109'		6-12"
32140	Ellis Av.	37th St.	Pershing Rd.	12" Duct.	1470'	3	2-6"
	Pershing Rd.	Cottage Grove Av.	Lake Park Av.	8" Duct.	54'		1-8"
	Cottage Grove Av.	37th St.	Pershing Rd.	6" Duct.	50'		6-12"
34501	LaSalle St.	225' NNL Cermak Rd.	150' SSL Cermak Rd.	12" Duct.	72'	1	2-8"
	21st St.	LaSalle St.	50' WWL LaSalle St.	8" Duct.	304'		
				6" Duct.	11'		
34501	23rd St.	LaSalle St.	Federal St.	12" Duct.	315'		
1st Supp.							
34505	18th St.	State St.	37' EEL State St.	24" Duct.	25'	1	1-6"
				6" Duct.	4'		
34537	Erie St.	Leavitt St.	Damen Av.	8" Duct.	1313'	2	3-8"
				6" Duct.	45'		
34543	Polk St.	Spaulding Av.	Homan Av.	12" Duct.	617'	2	1-12"
				6" Duct.	8'		
34550	Lamon Av.	Ohio St.	Kinzie Av.	8" Duct.	1268'		3-6"
				6" Duct.	30'		5-8"
34551	22nd Pl.	California Av.	Marshfield Blvd.	8" Duct.	840'	1	1-8"
				6" Duct.	14'		
34594	Clark St.	Madison St.	Adams St.	16" Duct.	799'	2	1-6"
				8" Duct.	20'		1-8"
				6" Duct.	52'		1-12"
							3-16"
34602 &	44th St.	Ellis Av.	337' WWL Ellis Av.	8" Duct.	802'	1	3-8"
1st Supp.	45th St.	Ellis Av.	349' WWL Ellis Av.	6" Duct.	14'		
	Alley W. of Ellis Av. - 44th St.		45th St.				
34606	Clark St.	Adams St.		16" Duct.	461'	1	2-16"
				12" Duct.	4'		
				8" Duct.	44'		

PIPE INSTALLED IN CENTRAL DISTRICT - 1969 (Continued)

Order No.	Street	From	To	Pipe Size	Feet	Hydts.	Valves
34620	Paulina St.	Washington St.	Lake St.	8" Duct.	636'	2	3-8"
	Maypole Av.	Ashland Av.	Paulina Av.				
34628	Ohio St.	St. Clair St.	Fairbanks Ct.	8" Duct.	30'		4-8"
34637	21st St.	Leavitt St.	Damen Av.	8" Duct.	1342'		
				6" Duct.	23'		
34638	Washtenaw Av.	36th St.	Pershing Rd.	8" Duct.	2046'	6	6-8"
				6" Duct.	42'		
34640	Wabash Av.	Grand Av.	Chicago Av.	12" Duct.	1772'		12-12"
				6" Duct.	33'		
34641	18th Pl.	Damen Av.	Leavitt St.	12" Duct.	4'	4	3-8"
				8" Duct.	1365'		
				6" Duct.	91'		
34642	14th Pl.	Canal St.	160' EEL Jefferson St.	12" Duct.	3'	2	2-8"
	Alley E.Jefferson St.	-14th St.	15th St.	8" Duct.	782'		
	15th St.	Jefferson St.	Alley East	6" Duct.	38'		
34644	35th St. Bridge			24" Duct.	379'		2-6"
				8" Duct.	10'		1-8"
				6" Duct.	72'		
36401 & 1st Supp.	Cullerton St.	Michigan Av.	Indiana Av.	12" Duct.	507'	1	2-12"
				8" Duct.	13'		
				6" Duct.	33'		
36408	Adams St.	Dearborn St.	LaSalle St.	16" Duct.	366'	2	1-8"
				12" Duct.	16'		3-16"
				8" Duct.	37'		
				6" Duct.	11'		
36409	Clark St.	Jackson Blvd.	Harrison St.	16" Duct.	1199'	1	1-8"
				12" Duct.	28'		2-12"
				8" Duct.	16'		6-16"
				6" Duct.	22'		
36411	Pershing Rd.	Wolcott Av.	Honore St.	12" Duct.	227'		2-12"
36413	47th St.	Hamlin Av.	Pulaski Rd.	12" Duct.	12'	2	3-8"
				8" Duct.	1361'		
				6" Duct.	17'		

PIPE INSTALLED IN CENTRAL DISTRICT - 1969 (Continued)

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
36414	Race Av.	Elizabeth Av.	Racine Av.	8" Duct.	560'		1-8"
				6" Duct.	18'		
36425	Jackson Blvd.	Dearborn St.	Clark St.	16" Duct.	7'	2	1-6"
				12" Duct.	348'		2-12"
				8" Duct.	25'		
				6" Duct.	31'		
				12" Duct.	155'		
36426	Madison St.	Dearborn St.	Clark St.	8" Duct.	1361'		2-8"
36451	22nd Pl.	Damen Av.	Leavitt St.	6" Duct.	44'		
				8" Duct.	797'	1	4-8"
36459	23rd Pl.	Leavitt St.	Oakley Av.	6" Duct.	34'		
				16" Duct.	6'	1	1-8"
36464	23rd Pl.	Oakley Av.	Western Av.	8" Duct.	488'		
				6" Duct.	12'		
				8" Duct.	648'	1	1-8"
36468	23rd Pl.	Leavitt St.	Hoyne Av.	6" Duct.	16'		
				12" Duct.	18'	8	3-8"
36469	Hermitage Av.	43rd St.	47th St.	8" Duct.	2620'		1-12"
				6" Duct.	24'		

PIPE INSTALLED IN SOUTH DISTRICT - 1969

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
28898	Leamington Av. Sewer System - Contract No. 3-A			12" Duct.	167'	12	8-8"
				8" Duct.	8906'		
28930	Central South Side Sewer System - Contract No. 3-D			8" Duct.	881'		2-6"
30518	Central South Side Sewer System - Contract No. 2-F			8" Duct.	280'		
				6" Duct.	80'		
32190	56th St.	Cottage Grove Av.	Drexel Av.	12" Duct.	688'	2	1-8"
				8" Duct.	48'		1-12"
				6" Duct.	25'		
32310	Leamington Av. Sewer System - Contract No. 2-C			12" Duct.	48'	4	1-8"
				8" Duct.	643'		
				6" Duct.	74'		
32360 & 1st Supp.	Ashland Av. and 63rd St. Intersection			6" Duct.	32'		1-6"
34805	Dan Ryan Expressway at 63rd St. C.T.A. Station			12" Duct.	74'		
34853	Pulaski Rd.	111th St.	115th St.	42" Conc.	2517'	4	5-12"
				36" Conc.	60'		2-36"
				36" Duct.	73'		
				16" Duct.	181'		
34960	77th St.	Springfield Av.	Pulaski Rd.	12" Duct.	6'	1	1-12"
	Springfield Av.	77th St.	166' SSL 77th St.	8" Duct.	616'		1-8"
34957	60th	285' EEL Nottingham	580' EEL Nottingham	12" Duct.	286'	1	
				6" Duct.	10'		
36405	LaSalle St.	79th St.	83rd St.	12" Duct.	19'	8	6-8"
				8" Duct.	2610'		
				6" Duct.	95'		
36412	65th St.	5' EEL Long Av.	23' EEL Long Av.	8" Duct.	54'		
36415	84th St.	Keeler Av.	Kolin Av.	8" Duct.	1087'		4-8"
36416	Woodlawn Av.	94th St.	95th St.	12" Duct.	616'	1	1-6"
				6" Duct.	18'		1-12"
36417	Harding Av.	30' SSL 104th Pl.	100' SSL 104th Pl.	8" Duct.	70'		
36418	Ewing Av.	115th St.	116th St	8" Duct.	90'		

PIPE INSTALLED IN SOUTH DISTRICT - 1969 (Continued)

Order No.	Street	From	To	Pipe Size	No. of Feet	Hydts.	Valves
36419	Hamilton Av.	69th Pl.	70th Pl.	3" Duct.	706'		1-6"
36421	106th St.	141' EEL Springfield	Springfield Av.	8" Duct.	199'		1-8"
36422	105th St.	137' EEL Hamlin Av.	Hamlin Av.	8" Duct.	181'		1-8"
36423	104th St.	Millard Av.	Central Park Av.	8" Duct.	326'		1-8"
36433	110th Pl.	Whipple St.	263' EEL Whipple St.	8" Duct.	272'	1	
				6" Duct.	18'		
36439	114th St.	Sawyer Av.	Spaulding Av.	8" Duct.	340'		1-8"
36444 & 1st Supp.	53rd St.	Kildare Av.	Kolin Av.	8" Duct.	331'		1-8"
36446 & 1st Supp.	Avenue O	117th St.	118th St.	12" Duct.	158'	2	2-12"
				8" Duct.	517'		
36448	Racine Av.	96th St.	97th St.	8" Duct.	406'	1	2-8"
				6" Duct.	6'		
36449	Langley Av.	108th St.	562' SSL 108th St.	12" Duct.	616'	1	1-12"
				8" Duct.	19'		
36455	Ewing Av.	125' NNL 116th St.	116th St.	8" Duct.	127'	1	1-8"
36463	Lawndale Av.	79th St.	79th Pl.	8" Duct.	2030'		7-8"
	Lawndale Av.	80th St.	82nd Pl.				
36466	Central Park Av.	79th St.	80th St.	8" Duct.	653'		3-8"
36467	Christiana Av.	195' SSL 106th St.	265' SSL 106th St.	8" Duct.	70'	1	
				6" Duct.	6'		
36471	Stony Island Av.	122nd St.	338' SSL 122nd St.	12" Duct.	417'	1	1-12"
				6" Duct.	18'		
36473	Central Park Av.	80th Pl.	81st St.	8" Duct.	381'		2-8"

Field Engineering Service Unit

Measuring, locating, and stopping non-evident underground street leakage by trained personnel, under engineering supervision, has been a regular function of this Division since 1916. The underground leakage originates from water mains and service pipes in the street, up to and including the service pipe shut-off valve near the curb.

The methods employed by the engineering personnel to measure and locate underground leakage include:

1. Closed Meter Tests for Measuring

   Tests consist of isolating one or more sections of pipe, shutting off all service pipes and valves on the mains being tested and measuring with a by-pass meter the leakage in the isolated section of pipe.

2. Dye Tests for Locating

   This method consists of injecting dye under pressure into the leaking section of the water main or service pipe with all service pipes closed off. The dye travels toward the leak and from the results observed, the leak location may be determined. This method was developed by engineers of the Water Distribution Division.

3. Aquaphone Tests for Locating

   Tests with the aquaphone consist of listening where contact can be made with the main, valves, fire hydrant, service pipe or other appurtenance. This is a simple and rapid method of discovering underground street leakage under certain conditions.

4. Sound Level Meter Tests for Locating

   The electro-sonic method using sound level meters to locate underground leakage was introduced experimentally late in 1961. This method has proved very successful and its use has been rapidly expanded. It is essentially similar to the aquaphone method in that it depends upon detecting sound of leaking water. The sound level meters amplify the sound and measure the sound intensity in decibels which are indicated on the meter. The sound of the water leak may be further identified with the use of head phones which are part of the sound level meters, by contacting hydrants, valves, service pipes or other water main appurtenances. In sections of mains where leakage is indicated the leak may be pinpointed by measuring the sound intensity of the leaks at various points on the water main being tested.

Since 1963 the method used to locate leakage has been almost exclusively electro-sonic using a sound level meter as the main component. The equipment and techniques were developed by engineers of the Division working in the Field Engineering Service Unit. This method of leak detection is very fast, accurate, and permits closer monitoring and control of underground leakage. For example, from 1931 to 1962, a period of 32 years, using methods 1 through 3, 5,300 miles of pipe were tested. Using electro-sonic methods for the last seven years, 14,870 miles of main were tested and 16,274 leaks located.

The first, second and third surveys of the distribution system have been completed; the fourth survey is approximately 32% completed.

During 1969 a total of 3,544.29 miles of pipe were investigated for water leaks. Of this total, 30.00 miles were investigated as a result of requests from the Engineer of Water Distribution, District Superintendents, and municipal and private utilities; the balance of 3,514.29 miles were investigated under routine procedures.

A total of 2,565 locations of suspected water leaks were reported during 1969. Of this total, 196 locations were reported as a result of the aforementioned special investigations.

District forces repaired 2,614 water leaks at locations designated by the Field Engineering Service Unit. Complete statistics of the underground leakage program are shown on a following table.

In addition, 94.58 miles of the distribution system were carefully investigated in the first phase of a Feeder Main Survey and the Grid Main Replacement Program. The mileage indicated above is not included in our leakage survey totals. 83.32 miles of feeder main were carefully surveyed for the Feeder Main Survey and 11.26 miles of pipe were investigated as a result of requests from Division Engineers under the Grid Main Replacement Program.

During 1969, 105 fire-flow tests were performed upon requests from the Engineer of Water Distribution to ascertain specific area water main capacities and fire protection abilities, and upon request from various Underwriters and Insurance Companies to determine the quantity of water available for sprinkler fire protection systems.

The Field Engineering Service Unit sterilized 23.97 miles of pipe, ranging in size from 8" to 78", with chlorine gas, according to recommended practices and procedures during 1969. The following tabulation shows the size and length of pipe chlorinated during 1969.

Size	Total Length
8"	50,097 Ft.
12"	20,038 "
16"	8,915 "
24"	12,400 "
30"	2,700 "
36"	28,530 "
42"	2,900 "
48"	165 "
78"	800 "

During 1969, the Field Engineering Service Unit continued the suburban water meter testing program with excellent results. Early in the year, one crew was permanently assigned to the program. All suburban meters are tested approximately once a month. This frequency seems to be adequate. Sixty-one "Requests for Meter Repairs" were issued during 1969.

Another function of this Unit includes testing of meters in place to determine if the proper size and types are being used; to investigate complaints of high bills and low pressures; and to investigate requests for larger meters. These tests, performed by an instrument called a "Meter Master", show maximum and minimum rates of consumption and are used to check the adequacy of the meter being checked. The following list shows the fourteen locations where the meter master was used during 1969. The tests were a result of requests by the Engineer of Water Distribution and the Plumbing Inspectors.

SUMMARY OF FIRE-FLOW TESTS 1969

1 of 3
DISTRICT
TABLE No.

NOTE. WHEN ONLY ONE HYDRANT IS USED IT IS CAPACITY TEST TO DETERMINE QUANTITY OF WATER AVAILABLE FOR SPRINKLER FIRE PROTECTION SYSTEMS

ATLAS PAGE	LOCATION OF CENTER OF TEST	DATE	DISCHARGE IN GPM								TOTAL OF GROUP	PRESSURE IN PSI		QUANTITY REQUIRED GPM	ESTIMATED QUANTITY AVAILABLE AT 10 POUNDS PRESSURE-GPM
			INDIVIDUAL HYDRANTS									HYDRANTS			
												CLOSED	OPEN		
31	Hood, 300' EEL Lakewood	4-7	1280	1930							3210	40	17		3659
31	Hood, NEX Lakewood	4-7	1090	1120							2210	40	8		2143
31	Hood, 300' EEL Glenwood	4-7	1310	1250							2560	39	13		2713
31	Hood, NEX Glenwood	4-7	1190	1490							2680	39	26		3993
31	Glenlake, 300' EEL Glenwood	4-8	1890	1360							3250	40	25		4582
31	Glenlake, 600' EEL Glenwood	4-8-	940	1050							1990	40	13		2089
31	Glenlake, NWX Glenwood	4-8	1220	1390							2610	41	33		5141
31	Norwood, 300' WWL Broadway	4-8-	1120	1660							2780	40	14		2975
31	Norwood, 600' EEL Glenwood	4-8	860	1090							1950	40	7		1853
31	Norwood, 300' EEL Glenwood	4-8	1440	1280							2720	39	20		3345
31	Norwood, NEX Glenwood	4-8-	1280	1470							2750	39	28		4455
31	Glenlake, 300' WWL Broadway	4-8-	1160	1160	1490	1490					5300	40	22		6837
40	Pulaski, 400' SSL Peterson	12-18	1720								1720	38	26		2632
40	Bryn Mawr, NWX Kedvale	12-18	1440	1440							2880	38	29		5069
40	Rogers, 1250' NEEL Kostner	1-29	1390								1390	33	25		2349
40	Rogers, 880' NEEL Kostner	1-29	1760								1760	33	25		2974
40	Bryn Mawr, 250' EEL Kostner	1-24	2720								2720	36	29		5250
40	Pulaski, 450' NNL Bryn Mawr	1-24	2000								2000	36	30		4160
40	Pulaski, 900' SSL Peterson	1-24	1850								1850	35	22		2572
48	Broadway, SEX Hollywood	2-25	1760								1760	40	36		4822
53	Bryn Mawr, NWX Kedvale	5-2	1390	1390							2780	30	23		4698
72	Argyle, 300' EEL Wolcott	8-25	1810								1810	41	34		3800
74	Sheridan, SEX Winona	9-25	1680								1680	47	43		5107
74	Sheridan, SEX Winona	9-25	1930								1930	47	43		5867
85	Lawrence, 300' EEL Damen	8-25	2440								2440	42	38		5685
168	Lakewood, 300' NNL Schubert	4-16	1850								1850	30	26		4144
170	Hampden Ct. 260' NNL Wrightwood	2-25	1090								1090	35	16		1254
185	Webster, NWX Elston	5-23	1810								1810	34	33		8869
196	Wabansia, NWX Kostner	3-7	1760								1760	38	28		2939
206	Howe, 800' NNL Willow	9-24	270	860							1130	33	11		1153

SUMMARY OF FIRE-FLOW TESTS 1969

2 of 3
DISTRICT
TABLE No.

NOTE: WHEN ONLY ONE HYDRANT IS USED IT IS CAPACITY TEST TO DETERMINE QUANTITY OF WATER AVAILABLE FOR SPRINKLER FIRE PROTECTION SYSTEMS

ATLAS PAGE	LOCATION OF CENTER OF TEST	DATE	DISCHARGE IN GPM										PRESSURE IN PSI		QUANTITY REQUIRED GPM	ESTIMATED QUANTITY AVAILABLE AT 10 POUNDS PRESSURE-GPM
			INDIVIDUAL HYDRANTS									TOTAL OF GROUP	HYDRANTS			
													CLOSED	OPEN		
206	Orchard, 600' NNL Willow	9-25	610	670								4339	33	31		4339
219	North Ave. NWX Magnolia	12-18	2660	390								3050	34	18		3721
219	North Ave. NWX Magnolia	12-18	770									770	34	30		1887
219	North Ave. SWX Magnolia	3-12	1160	1160								2320	30	19		3132
235	Haddon, 300' EEL Ashland	8-20	1720									1720	30	25		3,440
235	Haddon, SEX Ashland	8-20	1970									1970	30	28		6,225
236	No. Branch 400' WWL Halsted	12-18	1440									1440	39	28		2333
236	Fry, NWX May St.	1-31	1970									1970	33	30		5457
253	Kinzie, 50' WWL Milwaukee	6-5	4500	4500								9000	37	34		27,000
264	Carroll, NWX Sacramento	9-3	1330									1330	29	24		2,594
275	Madison, 100' EEL Central	9-5	2250									2250	35	30		5,040
284	Damen, SWX Jackson	8-11	2720	1930								4650	30	26		10,416
284	VanBuren, NWX Damen	8-11	2240	1930								4170	31	28		11,050
312	Rockwell, 150'NNL 13th. St.	4-24	1540	1540								3080	35	31		7700
312	Rockwell, NEX Ogden	4-24	1540									1540	35	32		4451
313	Hoyne, NEX Washburne	8-6	1280									1280	34	25		2086
336	Trumbull, NEX 25th. St.	10-6	1020	770	1720	1810						5320	42	8		5320
339	Leavitt 300'SSL Blue Is.	5-2	1220									2440	36	28		4392
343	Union, 200' NNL Lumber	2-27	2040									2040	42	34		4080
345	King Dr. SEX 74th. St.	3-12	2720	2440								5160	35	30		11,500
355	Archer, NEX Poplar	1-15	1330	1330								2660	38	34		7049
355	Quinn St. 600'NNL 31st.St.	10-8	720	720								1440	34	5		1310
379	Washtenaw 300' SSL 36th.	8-4	2560									2560	37	33		6656
379	Washtenaw 300' SSL 36th.	8-4	2440									2440	37	33		6344
382	37th. St. NWX Iron St.	2-19	1850									1850	38	19		4211
383	38th. Pl. NEX Sangamon	11-14	1760									1760	35	30		3942
390	Karlov, SEX 40th. St.	4-24	2110									2110	38	24		2975
395	Hamilton, SEX 39th. St.	4-24	1890	1890								3780	40	38		14,629
395	43rd. St. 300' WEL Damen	3-13	2080									2080	38	37		11,000
396	43rd. St. 300' EEL Damen	4-24	2080									2080	40	38		8050

SUMMARY OF FIRE-FLOW TESTS 1969

3 of 3
DISTRICT
TABLE No.

NOTE: WHEN ONLY ONE HYDRANT IS USED IT IS CAPACITY TEST TO DETERMINE QUANTITY OF WATER AVAILABLE FOR SPRINKLER FIRE PROTECTION SYSTEMS

ATLAS PAGE	LOCATION OF CENTER OF TEST	DATE	DISCHARGE IN GPM									PRESSURE IN PSI		QUANTITY REQUIRED GPM	ESTIMATED QUANTITY AVAILABLE AT 10 POUNDS PRESSURE-GPM
			INDIVIDUAL HYDRANTS								TOTAL OF GROUP	HYDRANTS CLOSED	HYDRANTS OPEN		
410	16' EEL Western 9' NL 45th.	9-29	1220								1220	39	30		2184
422	Archer, NWX Ridgeway	7-22	1390	1390							2780	40	38		10,759
448	Wabash, NEX 53rd. St.	11-3	670	770	1490	1760					4690	32	22		6988
467	57th.St. 300'WWL University	4-7	1630	1090	1720	1090					5530	32	20		7465
484	Ellis, NEX 61st. St.	4-10	610								610	34	18	744	
484	Ellis, NEX 61st. St.	4-10	550	670							1220	36	6	1135	
484	Ellis, 300' SSL 61st. St.	4-10	860								860	33	15	971	
484	Ellis, 300' SSL 61st. St.	4-10	550	610							1160	35	5		1056
484	Ellis, NEX 61st. St.	4-21	550	550	640	470					2210	35	5		2011
500	Vernon, SEX 63rd. St.	2-11	1120								1120	35	30		2509
500	Vernon, SEX 63rd. St.	3-19	1160								1160	34	29		2,540
502	Kenwood, NEX Marquette	8-11	770	1320	1090	1720					4900	43	36		10,633
502	Kenwood, NEX 64th. St.	8-11	670	860	940	940					3410	39	29		5797
502	Dorchester 600'NNL Marquette	9-5	940	770	1020						2730	41	5		2,538
502	Dorchester 300' NNL 64th.	9-5	1330	2210							3540	38	15		3,894
502	63rd. Pl.100' WWL Blackstone	9-5	1440	1330							2770	40	15		3,019
502	Harper NEX 63rd. Pl.	9-5	1220	1220	1280						3720	41	12		3,831
502	66th. Pl. NEX Blackstone	9-5	1090	860	860						2810	45	7		2,697
502	65th. Pl. 300'EEL Dorchester	9-5	1440	1630	1720						4790	41	23		6,274
523	Pulaski 680'NNL 75th. St.	7-17	3220	3290							6510	34	29		14,256
527	Maplewood NWX 74th. St.	11-11	1490	1540							3030	37	17		3515
556	Avalon, opposite 77th. St.	11-4	770	770	770	670	610				3590	37	7		3410
556	Avalon, opposite 77th. St.	11-4	1280	860	940						3080	39	10		3080
557	Cornell NEX 76th. St.	2-25	2000								2000	39	29		3400
573	Michigan 300' SSL 81st. St.	11-11	1090								1090	37	28		1886
593	LaFayette NEX 85th. St.	9-12	3860	4040							7900	41	33		15,563
593	LaFayette 300' SSL 85th.St.	9-12	3860	3860							7720	42	33		14,591
619	Longwood, opposite 91st.St.	11-11	610	1020	1720						3350	40	8		3250
626	95th.St.300'EEL Cottage Gr.	7-22	1890								1890	45	40		5,009
627	Avalon,NWX 92nd. St.	10-31	1390	1090							2480	37	27		4067

SUMMARY OF FIRE-FLOW TESTS 1969

DISTRICT

TABLE No.

NOTE: WHEN ONLY ONE HYDRANT IS USED IT IS CAPACITY TEST TO DETERMINE QUANTITY OF WATER AVAILABLE FOR SPRINKLER FIRE PROTECTION SYSTEMS

ATLAS PAGE	LOCATION OF CENTER OF TEST	DATE	DISCHARGE IN GPM — INDIVIDUAL HYDRANTS								TOTAL OF GROUP	PRESSURE IN PSI — HYDRANTS CLOSED	PRESSURE IN PSI — HYDRANTS OPEN	QUANTITY REQUIRED GPM	ESTIMATED QUANTITY AVAILABLE AT 10 POUNDS PRESSURE-GPM
631	92nd St. 200 WWL Commercial	4-16	2110								2110	35	30		4726
631	92nd St. 200 WWL Commercial	4-16	3080								3080	35	30		6900
641	97th & Cottage Grove	3-6	2180								2180	38	36		8153
658	103rd St. SEX Stony Island	1-31	2380								2380	38	28		3975
677	Indianapolis 400 NNW 105th	10-22	1330	1680							3010	43	18		3462
681	Langley NWX 108th St.	7-11	1330								1330	51	44		3218
710	120th St. 100 WWL Racine	4-16	3180	3360	2980						9520	49	26		12,471
710	120th St. 550 WWL Racine	4-23	1630	1490	1160	2040					5320	50	18		5958
710	120th St. 550 WWL Racine	4-23	1540	1390	1020	2000	1330				7280	50	15		7717
710	Throop, SWX I.C.R.R.	4-23	1540	1280	1020						3840	50	18		4300
780	Narragansett, SWX 51st St.	5-29	2250								2250	30	25		4500
810	Spaulding NEX 112th Pl.	5-12	1020	550	980	1280					3830	39	8		3715
810	St. Louis, NEX 112th Pl.	5-12	1090	1020	1160	1220					4490	41	11		4624
810	Spaulding, NEX 114th St.	5-12	940	770	860						2570	41	6		2415
810	Spaulding, NEX 115th St.	5-12	770	550							1320	41	5		1227

METER MASTER TESTS

6" Service 132' W.W.L. Jefferson St.S.L. 21st St.	12-5-68 to 12-6-68
4" Service 90' N.N.L. 21st St., W.L. Jefferson St.	12-5-68 to 12-6-68
4" Service 215' N.N.L. 21st St., E.L.Desplaines St.	12-5-68 to 12-6-68
4" Service 196' N.N.L. Cermak Rd., E.L.Jefferson St.	12-5-68 to 12-6-68
Apartment Building 2740-46 Hampden Ct.	1-12-69 to 1-13-69
Marriott Inn Motel 8335 W.Higgins Rd.	2-10-69 to 2-17-69
O'Hare Plaza 8501 W.Higgins Rd.	2-10-69 to 2-17-69
Marriott Inn Conference Bldg. 8655 W.Higgins Rd.	2-10-69 to 2-17-69
Central Plaza Hotel 321 N.Central Av.	4-9-69 to 4-11-69
Apartment Building 137-45 N.Mason Av.	4-9-69 to 4-11-69
Lakeside Central 2941 W.31st St.	4-30-69 to 5-2-69
Edgewater Hospital 5700 N.Ashland Av.	5-22-69 to 5-23-69
Elmwood Park N.W.X. Fullerton & Harlem Av.	6-30-69 to 7-2-69
Chicago Etching Corporation 926 W.Weed St.	11-10-69 to 11-14-69